SMITHSONIAN

CONTRIBUTIONS TO KNOWLEDGE.

VOL. VII.

EVERY MAN IS A VALUABLE MEMBER OF SOCIETY, WHO, BY HIS OBSERVATIONS, RESEARCHES, AND EXPERIMENTS, PROCURES KNOWLEDGE FOR MEN.—SMITHSON.

CITY OF WASHINGTON:
PUBLISHED BY THE SMITHSONIAN INSTITUTION.
MDCCCLV.

ADVERTISEMENT.

THIS volume forms the seventh of a series, composed of original memoirs on different branches of knowledge, published at the expense, and under the direction of the Smithsonian Institution. The publication of this series forms part of a general plan adopted for carrying into effect the benevolent intentions of JAMES SMITHSON, Esq., of England. This gentleman left his property in trust to the United States of America, to found at Washington an institution which should bear his own name, and have for its objects the "*increase* and *diffusion* of knowledge among men." This trust was accepted by the Government of the United States, and an Act of Congress was passed August 10th, 1846, constituting the President and the other principal executive officers of the general government, the Chief Justice of the Supreme Court, the Mayor of Washington, and such other persons as they might elect, honorary members, an establishment under the name of the "SMITHSONIAN INSTITUTION FOR THE INCREASE AND DIFFUSION OF KNOWLEDGE AMONG MEN." The members and honorary members of this establishment are to hold stated and special meetings for the supervision of the affairs of the Institution, and for the advice and instruction of a Board of Regents, to whom the financial and other affairs are entrusted.

The Board of Regents consists of three members ex officio of the establishment, namely, the Vice-President of the United States, the Chief Justice of the Supreme Court, and the Mayor of Washington, together with twelve other members, three of whom are appointed by the Senate from its own body, three by the House of Representatives from its members, and six persons appointed by a joint resolution of both houses. To this board is given the power of electing a Secretary and other officers, for conducting the active operations of the Institution.

To carry into effect the purposes of the testator, the plan of organization evidently should embrace two objects—one, the increase of knowledge by the addition of new truths to the existing stock; the other, the diffusion of knowledge, thus increased, among men. No restriction is made in favor of any kind of knowledge, and hence each branch is entitled to, and should receive, a share of attention.

The Act of Congress, establishing the Institution, directs as a part of the plan of organization, the formation of a Library, a Museum, and a Gallery of Art, together with provisions for physical research and popular lectures, while it leaves to the Regents the power of adopting such other parts of an organization as they may deem best suited to promote the objects of the bequest.

After much deliberation, the Regents resolved to divide the annual income into two equal parts—one part to be devoted to the increase and diffusion of knowledge by means of original research and publications—the other half of the income to be applied in accordance with the requirements of the Act of Congress, to the gradual formation of a Library, a Museum, and a Gallery of Art.

The following are the details of the two parts of the general plan of organization provisionally adopted at the meeting of the Regents, Dec. 8th, 1847.

DETAILS OF THE FIRST PART OF THE PLAN.

I. To increase Knowledge.—*It is proposed to stimulate research, by offering rewards for original memoirs on all subjects of investigation.*

1. The memoirs thus obtained, to be published in a series of volumes, in a quarto form, and entitled "Smithsonian Contributions to Knowledge."

2. No memoir, on subjects of physical science, to be accepted for publication, which does not furnish a positive addition to human knowledge, resting on original research; and all unverified speculations to be rejected.

3. Each memoir presented to the Institution, to be submitted for examination to a commission of persons of reputation for learning in the branch to which the memoir pertains; and to be accepted for publication, only in case the report of this commission is favorable.

4. The commission to be chosen by the officers of the Institution, and the name of the author, as far as practicable, concealed, unless a favorable decision be made.

5. The volumes of the memoirs to be exchanged for the Transactions of literary and scientific societies, and copies to be given to all the colleges, and principal libraries, in this country. One part of the remaining copies may be offered for sale; and the other carefully preserved, to form complete sets of the work, to supply the demand from new institutions.

6. An abstract, or popular account, of the contents of these memoirs to be given to the public, through the annual Report of the Regents to Congress.

II. To increase Knowledge.—*It is also proposed to appropriate a portion of the income, annually, to special objects of research, under the direction of suitable persons.*

1. The objects, and the amount appropriated, to be recommended by counsellors of the Institution.

2. Appropriations in different years to different objects; so that, in course of time, each branch of knowledge may receive a share.

3. The results obtained from these appropriations to be published, with the memoirs before mentioned, in the volumes of the Smithsonian Contributions to Knowledge.

4. Examples of objects for which appropriations may be made —

(1.) System of extended meteorological observations for solving the problem of American storms.

(2.) Explorations in descriptive natural history, and geological, mathematical, and topographical surveys, to collect materials for the formation of a Physical Atlas of the United States.

(3.) Solution of experimental problems, such as a new determination of the weight of the earth, of the velocity of electricity, and of light; chemical analyses of soils and plants; collection and publication of articles of science, accumulated in the offices of Government.

(4.) Institution of statistical inquiries with reference to physical, moral, and political subjects.

(5.) Historical researches, and accurate surveys of places celebrated in American history.

(6.) Ethnological researches, particularly with reference to the different races of men in North America; also explorations, and accurate surveys, of the mounds and other remains of the ancient people of our country.

I. To diffuse Knowledge.—*It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge not strictly professional.*

1. Some of these reports may be published annually, others at longer intervals, as the income of the Institution or the changes in the branches of knowledge may indicate.

2. The reports are to be prepared by collaborators, eminent in the different branches of knowledge.

3. Each collaborator to be furnished with the journals and publications, domestic and foreign, necessary to the compilation of his report; to be paid a certain sum for his labors, and to be named on the title-page of the report.

4. The reports to be published in separate parts, so that persons interested in a particular branch, can procure the parts relating to it without purchasing the whole.

5. These reports may be presented to Congress, for partial distribution, the remaining copies to be given to literary and scientific institutions, and sold to individuals for a moderate price.

The following are some of the subjects which may be embraced in the reports:—

I. PHYSICAL CLASS.

1. Physics, including astronomy, natural philosophy, chemistry, and meteorology.
2. Natural history, including botany, zoology, geology, &c.
3. Agriculture.
4. Application of science to arts.

II. MORAL AND POLITICAL CLASS.

5. Ethnology, including particular history, comparative philology, antiquities, &c.
6. Statistics and political economy.
7. Mental and moral philosophy.
8. A survey of the political events of the world; penal reform, &c.

III. LITERATURE AND THE FINE ARTS.

9. Modern literature.
10. The fine arts, and their application to the useful arts.
11. Bibliography.
12. Obituary notices of distinguished individuals.

II. To diffuse Knowledge.—*It is proposed to publish occasionally separate treatises on subjects of general interest.*

1. These treatises may consist of valuable memoirs translated from foreign languages, or of articles prepared under the direction of the Institution, or be procured by offering premiums for the best exposition of a given subject.

2. The treatises to be submitted to a commission of competent judges, previous to their publication.

DETAILS OF THE SECOND PART OF THE PLAN OF ORGANIZATION.

This part contemplates the formation of a Library, a Museum, and a Gallery of Art.

1. To carry out the plan before described, a library will be required, consisting, 1st, of a complete collection of the transactions and proceedings of all the learned societies in the world; 2d, of the more important current periodical publications, and other works necessary in preparing the periodical reports.

2. The Institution should make special collections, particularly of objects to verify its own publications. Also a collection of instruments of research in all branches of experimental science.

3. With reference to the collection of books, other than those mentioned above, catalogues of all the different libraries in the United States should be procured, in order that the valuable books first purchased may be such as are not to be found elsewhere in the United States.

4. Also catalogues of memoirs, and of books in foreign libraries, and other materials, should be collected, for rendering the Institution a centre of bibliographical knowledge, whence the student may be directed to any work which he may require.

5. It is believed that the collections in natural history will increase by donation, as rapidly as the income of the Institution can make provision for their reception, and, therefore, it will seldom be necessary to purchase any article of this kind.

6. Attempts should be made to procure for the gallery of art, casts of the most celebrated articles of ancient and modern sculpture.

7. The arts may be encouraged, by providing a room, free of expense, for the exhibition of the objects of the Art-Union, and other similar societies.

8. A small appropriation should annually be made for models of antiquity, such as those of the remains of ancient temples, &c.

9. The Secretary and his assistants, during the session of Congress, will be required to illustrate new discoveries in science, and to exhibit new objects of art; distinguished individuals should also be invited to give lectures on subjects of general interest.

In accordance with the rules adopted in the programme of organization, each memoir in this volume has been favorably reported on by a commission appointed

for its examination. It is, however, impossible, in most cases, to verify the statements of an author, and, therefore, neither the Commission nor the Institution can be responsible for more than the general character of a memoir.

The following rules have been adopted for the distribution of the quarto volumes of the Smithsonian contributions.

1. They are to be presented to all learned societies which publish Transactions, and give copies of these, in exchange, to the Institution.

2. Also, to all foreign libraries of the first class, provided they give in exchange their catalogues or other publications, or an equivalent from their duplicate volumes.

3. To all the colleges in actual operation in this country, provided they furnish, in return, meteorological observations, catalogues of their libraries and of their students, and all other publications issued by them relative to their organization and history.

4. To all States and Territories, provided there be given, in return, copies of all documents published under their authority.

5. To all incorporated public libraries in this country, not included in any of the foregoing classes, now containing more than 7000 volumes; and to smaller libraries, where a whole state or large district would be otherwise unsupplied.

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* Each memoir is separately paged and indexed.

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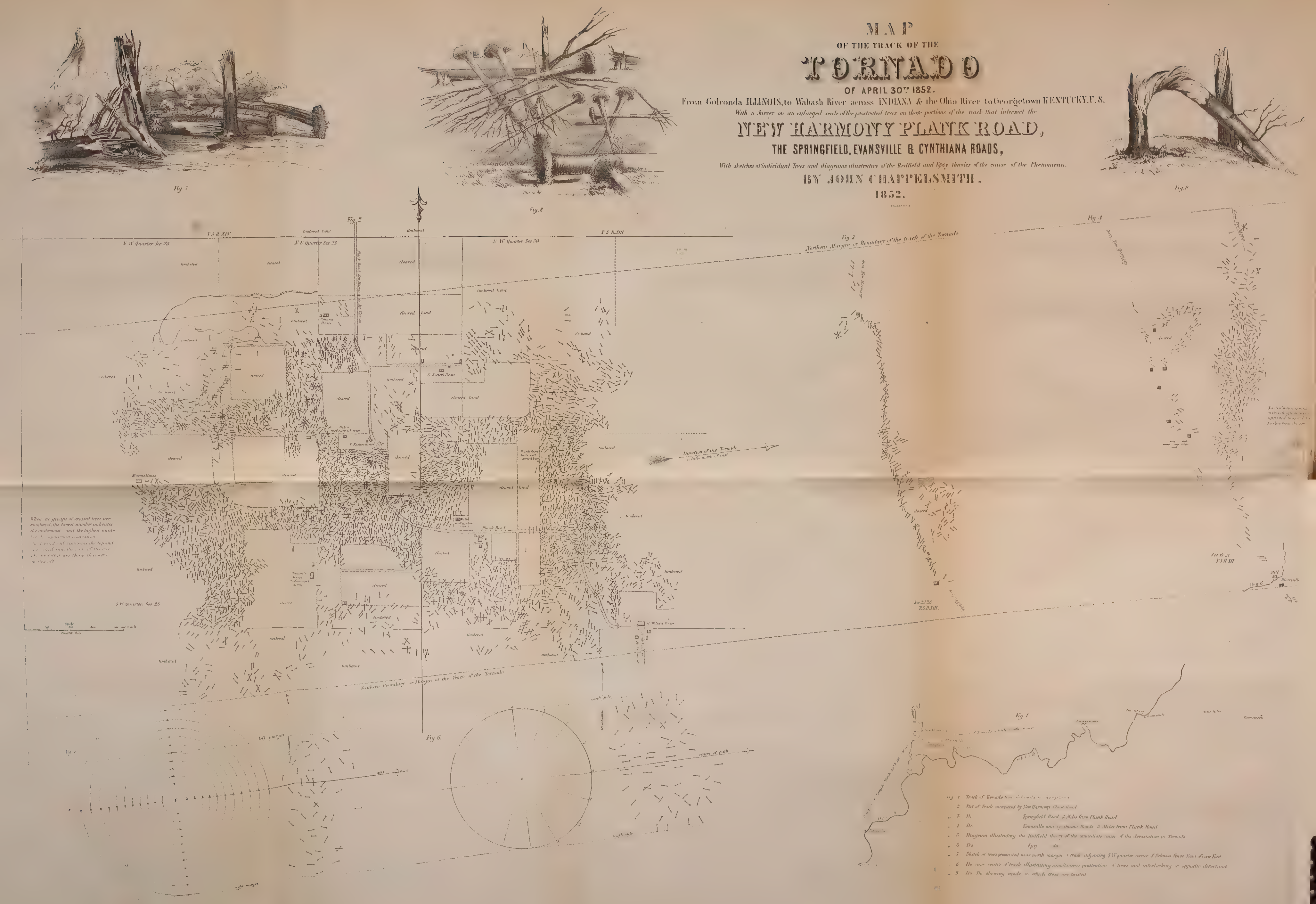

MAP
OF THE TRACK OF THE
TORNADO
OF APRIL 30TH 1852.
From Golconda ILLINOIS, to Wabash River across INDIANA & the Ohio River to Georgetown KENTUCKY, U.S.
With a Survey on an enlarged scale of the prostrated trees on those portions of the track that intersect the
NEW HARMONY PLANK ROAD,
THE SPRINGFIELD, EVANSVILLE & CYNTHIANA ROADS,
With sketches of individual Trees and diagrams illustrative of the Redfield and Espy theories of the cause of the Phenomena.
BY JOHN CHAPPELSMITH.
1852.
Fig 7
Fig 8
Fig 9
Fig 2
Fig 3
Fig 4
Fig 6
Fig 1
Northern Margin or Boundary of the track of the Tornado
Southern Boundary or Margin of the Track of the Tornado
Direction of the Tornado
S W Quarter Sec 25
S E Quarter Sec 23
N W Quarter Sec 30
Plank Road
timbered
cleared
cleared land
timbered land
Fig 3 Do Springfield Road 2 Miles from Plank Road
Fig 5 Diagram illustrating the Redfield theory of the immediate cause of the devastation in Tornado
Fig 9 Do Do showing mode in which trees are twisted


made
between
nd those
stem.

ACCOUNT

OF A

TORNADO NEAR NEW HARMONY, IND.,

APRIL 30, 1852,

WITH A MAP OF THE TRACK, &c.

BY

JOHN CHAPPELSMITH.

[ACCEPTED FOR PUBLICATION, DECEMBER, 1853.]

COMMISSION

TO WHICH THIS PAPER HAS BEEN REFERRED.

Prof. J. H. Coffin.
Prof. A. Caswell.

Joseph Henry,
Secretary S. I.

ACCOUNT OF A TORNADO,

THAT PASSED NEAR NEW HARMONY, INDIANA, APRIL 30, 1852.

WITH A MAP OF THE TRACK, DIAGRAMS, AND ILLUSTRATIVE SKETCHES.

As every accurately observed meteorological fact must be of importance in the necessary accumulation of data, from which the phenomena of storms are to be understood, and the laws which govern them deduced, I am led to believe that a map and memoir illustrating the tornado which recently passed near New Harmony, Indiana, will be of some service to the cause in which so many are at present engaged.

On April 30, 1852, a tornado crossed the New Harmony Plank road, five miles south of the town, about five o'clock in the afternoon; its velocity, and the length and breadth of its destructive violence, exceed that of any, to my knowledge, on record. From within three miles of Golconda, Illinois, its course appears to have been north 30° east to the Wabash river, a distance of fifty miles; crossing the river near Grand Chain rapids, it altered its course to east, or rather to a little north of east, and continued apparently in this to about four miles north of Georgetown, Kentucky, a distance of 200 miles. At different localities, from Golconda to Georgetown, the tornado is described as manifesting similar evidences of its destructive power; buildings being blown down; houses and cabins unroofed; trees torn up by the roots, or their tops twisted off; fences scattered in every direction; and beds, bedding, and articles of every description being carried to various and considerable distances. See Figures 1, 2, 3, 4, of the map.

Fig. 1 is a map of the track of the tornado from Golconda, Illinois, to Georgetown, Kentucky, a distance of about 250 miles.

Fig. 2 is a survey of a square mile of the track east and west of the New Harmony Plank road, showing the compass-bearings of the prostrated trees; the crossed end represents the top of the tree; the dotted end, the root; where the dot is absent, the tree has been broken, or twisted from the stem.

Fig. 3 is a plot of the trees thrown across the road from New Harmony to Springfield, two miles east of the Plank Road; this road passes through a forest; a small portion is cleared, which is marked on the plot.

Fig. 4 is a plot of the road from New Harmony to Evansville, and of the Cynthiana road, eight miles east of the Plank road; the Evansville road is through cleared ground, but the Cynthiana road passes through a forest all the way to the mill at Big creek. The observations extend to about one hundred and fifty yards on each side of the road, except near the middle of the track, where they cover a wider space.

The tornado passed over Leavenworth on the Ohio, and a correspondent thus writes to the Louisville Courier of May 11: "The storm came from the southwest, across the bluff from the opposite side of the river, tearing up trees by the roots, or twisting off their tops; it then crossed the river, swelling the waves to an incredible height, lifting skiffs from the river bank, and dashing them to pieces against the houses. It struck the town about 6¼ P. M., and raged from three to five minutes, unroofing and prostrating sixty buildings, some of them the most substantial in the town, carrying off and blowing articles of every description about, killing one child, and wounding ten or fifteen individuals."

From persons residing on the track, or in its vicinity, no definite idea of the approach of the meteor can be obtained; some describe it as a cloud with green and red flame; others, green and blue. Mr. Stitt, who resides about the centre of the track, says the cloud appeared on fire at the bottom, like a large pile of burning brush, and that it rolled under and over; his wife felt the house lifted up and down several times. During the passage of the storm he opened the eastern door of his house, but speedily closed it from fear, for he saw the planks of his well spinning round eight or ten feet from the ground, and one of them was carried in a northeasterly direction, 400 yards, to the place marked in the map. All who reside on the track describe the destruction as the work of a moment; a person standing in his house, looking to the north, saw the trees thrown down, and at the same moment turning south, saw the trees falling there also. Persons in the woods describe the crash as so terrific, that, to use their own words, "they could hear nothing," by which I understand that they could not distinguish, amid the war of sounds, any sound in particular.

Referring to the observations made by myself, during the passage of the tornado, at New Harmony, five miles north of the axis of the track, I find that at 3 o'clock on April 27, the barometer stood at 29.587, the thermometer at 61°, and the force of vapor at .250 of an inch. On the 30th, at 3 o'clock, the barometer had fallen to 29.090, the thermometer had risen to 80°, and the force of vapor to .622 of an inch. The sky had been cloudy all day, and at this time the clouds were coming from the south, and the wind was nearly calm; sounds of distant thunder were now heard, and at 4 P. M. the first flash of lightning was perceptible, with thunder at an interval of twenty seconds, and slight rain. From this time the lightning was a continued glimmer, and the thunder a constant roll. The barometer had now risen .050 of an inch, and the thermometer had fallen 2°. At 4.30 P. M. the rain fell in torrents, the wind blew in all directions, with incessant flashes of lightning, and peals of thunder, and showers of driving hail, of which some stones measured eight inches in circumference, and weighed one-quarter of a pound; the panes of every window in the town, having a westerly exposure, were broken; there was now a further rise of .030 of an inch in the barometer, and a fall of 4° in the thermometer. At 5 P. M., after a few minutes' cessation, the storm still continued, though with abated violence. At 5.45 the sky was clear, the wind calm, the thermometer standing at 68°, and the barometer had fallen to the point at which it stood at the commencement of the storm. The force of vapor at 9 P. M. was diminished one-half.

While the tornado was raging here, so little inconvenience was experienced five miles to the north, from either wind or rain, that persons were able to continue ploughing during the whole passage of the storm. This was also the case at Mount Vernon, which is about the same distance, nine miles south of the axis of the track. The case was similar nine miles from the axis at Golconda; little of either wind or rain was experienced.

Considering these facts, and observing, as represented in Fig. 2, that on a square mile only of the track, thousands of trees, many of them having a stem at least fifteen feet in circumference, lie prostrated by a force operating simultaneously in opposite directions; considering, also, that the time of passage of the meteor from New Harmony to Leavenworth could not exceed 1½ hours, and that the velocity must therefore have been at least sixty miles in an hour, or one mile per minute, we may form some conception of the enormous and astonishing power with which this tornado, of whose presence at ten miles' distance there is not an indication, passed through the atmosphere, leaving behind a desolated track of one mile in breadth, on which trees, and among them the monarchs of the forest, were laid low at the rate of 7,000 a minute.

"In this vast country, where," as the Committee of the French Academy of Sciences say, "enlightened men are not wanting to science, and which is, besides, the home of these fearful meteors," it is surprising that a power like this should not have earlier attracted the attention of scientific men; for, according to Dr. Hare, it was not until 1835, that "the immediate mechanical causes of the devastation produced by tornadoes were well ascertained, by Professors Bache and Espy, from observations made by means of a compass at New Brunswick." Since then, the question of tornadoes has been much agitated, and it still remains a vexed one, and notwithstanding the hope indulged in by several investigators of this class of phenomena that their researches would solve the problem, the ultimate solution of the question is as much involved in difficulty as ever.

Before we can arrive at a satisfactory conclusion on this subject, we must first ascertain if the general phenomena in tornadoes be uniform, or dissimilar. For this purpose I will refer to the accounts of various tornadoes published in Silliman's Journal. I shall pass by the Providence tornado, in 1838, because the observations are too few in number.

The New Haven tornado, in 1839, was examined by Professor Olmstead, who considers his observations the result of better opportunities, and of more elaborate and careful investigation than is usual in storms of this class; he says: "With very few exceptions, the prostrations of all the trees are inwards, on both sides, to the centre of the track; near the centre they coincide with the direction of the storm." Out of forty prostrations which he represents on the north side of the axis, there are twelve exceptions of trees lying *outward* from the centre; and he says: "In a few instances, in very limited spots, the prostrated bodies lie in all directions."

The tornado at Mayfield, in Ohio, in 1842, had its track surveyed by Professor Loomis, who observes that tornadoes, in addition to their progressive motion, have a vertical, and two horizontal motions, one in the direction of, and the other at right angles to, a radius. These four motions have a variable ratio to each other; the

upward, and centripetal, nowhere disappears, and at Mayfield was exhibited in unequal strength. In some places the motion at right angles was strongly marked, in others "well nigh masked." He says that, having discovered a true *experimentum crucis*, for analyzing the phenomena of tornadoes by means of groups of crossed trees, "the peculiarities of a well-marked tornado can hardly escape detection," and concludes that though the motion at right angles to a radius may sometimes be quite small, compared with the centripetal motion, yet that it "can ever become mathematically nothing, is infinitely improbable." To prove the rotation of the wind, the Professor measured the bearings of seventy prostrate trees extending across the track; he "did not take the bearings of all indiscriminately, because it was a hopeless task, the prostrate trees being counted by thousands." He searched for trees crossing each other, and found but one case on the right side of the track near the middle; but on the left side the phenomena were very different; here was no difficulty in finding crossed trees, and he measured few others. The Professor gives the bearings of these, and the order in which they overlie each other. (See Silliman's Journal, XLIII, 285.)

A reference to the phenomena of these tornadoes shows that there is a general uniformity in their character, and that it is contrary to fact to say that the "trees, amid all their variety of bearing, always point towards the centre of the path, or a point occupied by the axis of the tornado," as affirmed by some; for out of forty prostrations on the north side of the axis at New Haven, Olmstead gives twelve exceptions of trees lying outwards from the centre; and on the north of the axis, at Mayfield, Loomis gives at least twenty trees pointing directly outwards from the centre, out of fifty prostrations; and the like effects are exhibited at New Harmony, as shown in Fig. 2.

It is improbable that any one can come to a right conclusion regarding the order in which the wreck of a tornado lies, without plotting a portion of it from instrumental survey. Knowing the tendency which exists in most minds to see chiefly those facts which favor a preconceived hypothesis, it seems to me that to select a few groups of trees out of thousands, would not afford sufficient evidence to others, however satisfied one might be with the truthfulness of his illustrations. I therefore present the plot of a square mile of track on which some 7 or 8,000 prostrated trees are represented in their relative positions, with the hope that the means will thus be furnished for more satisfactorily determining whether the "immediate mechanical cause of devastation in tornadoes" be a spirally involuted rotating moving column of air, or a vertical current at the centre of the tornado with a horizontal conflux from surrounding space to the moving axis.

To further this object, and to more readily compare the phenomena with the hypotheses, I have appended diagrams, illustrating the rotating cylinder, and the up-moving column, with prostrated trees, in accordance with these hypotheses respectively.

Fig. 5 of the map illustrates the rotating cylinder, which Redfield theoretically describes as follows: "The involuted lines or arrows represent the motion of the wind at the bottom of the cylindrical vertical portion of the tornado. The motion of a particle of air, as at *a*, quickens as it approaches the centre *f*, describing in its

spiral revolutions from a to f, equal areas in equal times; if the whirl was stationary, its force would be concentrically equal; but, if it have a constant progressive motion in the direction of the axis c, c at $\frac{1}{5}$ of the average rotative velocity, the force of the whirl will be increased on the right, and diminished on the left side, of the axis. Suppose the stationary velocity to be 80, then taking two equally distant points on each side of the axis, the force will be increased to 100 on the right side, and diminished to 60 on the left when the cylinder is advancing. The consequence of the rotative motion coinciding with the progressive is, that the prostrating power extends much further on the right of the axis than on the left, where, from the rotative being retarded by the progressive motion, the extent of the prostrating power is lessened." "With these views," continues Mr. Redfield, "follow the track of a tornado; and if it is a whirlwind, the result is a series of prostrations, pointing almost invariably onward and inward, with various degrees of inclination to the course of the tornado on one side; while the left of the axis presents a narrow band or belt of prostrations, also inclined mainly inward and onward, but showing a greater inclination from the line of progress, with frequent cases more or less backward, and sometimes outward, from the path."

Now the prostrating effect of this rotating cylinder will be best understood by a reference to the prostrated trees in Fig. 5, which correspond with the direction of the involuted lines in the whirl. Making allowance for a little more onward direction, owing to the progressive motion, we may deduce the following general conclusions: that on the right of the axis there cannot be any prostrations of trees with their tops to the west;[1] that those prostrated to the east cannot lie at a greater angle with the direction of the track than 45°, unless they be very near the axis; on the left of the track there cannot be any prostrations with the tops of the trees to the east, except near the axis; and in the case of crossed trees, those on the right of the axis, prostrated by the advanced portion of the whirl, will be undermost with a N. E. direction; and those thrown down by the rear, will have a S. E. direction, and overlie the northeasterly prostrations; on the left of the axis, the S. W. prostrations will lie over the northwesterly.

Apply these general principles to the square mile plot of the track at New Harmony, in Fig. 2, and observe if the conditions of the rotatory hypothesis are fulfilled. On the contrary, there are numerous prostrated trees with the tops to the west on the right of the axis; many southeasterly and northeasterly prostrations, making a greater angle than 45° with the direction of the course; there are also many northeasterly lying over southeasterly prostrations, as the groups of crossed trees show where numbered, the lowest numbered being the first prostrated, or undermost tree; the same opposition to the rotatory hypothesis exists on the left of the axis, as may be observed.

Turn now to Fig. 6 of the map, which is an illustration of the bottom of an up-moving column of air with horizontal conflux from surrounding space to the moving centre. Let o be the centre, and $a\,o$, $b\,o$, $c\,o$, &c., represent the horizontal conflux; the action of this moving column, according to Espy, will be to prostrate the trees, as

[1] It must be recollected that in the drawing the top of the map is north.

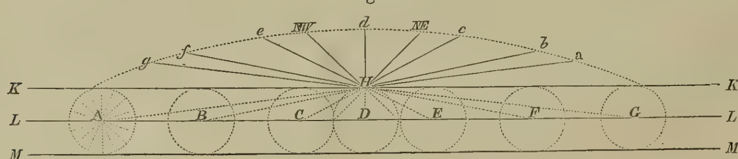
shown in diagram 6, and as described in his Meteorological Reports: "The manner in which the trees are thrown down where the tornado passes through a forest, will demonstrate the direction of the wind. The trees at the sides of the path of the tornado, as it moves in this latitude to the east, or a little north of east, will be thrown *inwards* towards the centre of the path, and those in the centre of the path will be thrown right backwards contrary to the motion of the tornado, or right forwards, according as some of them will be thrown down by the front part of the meteor, where the wind blows backwards, or by the rear, where the wind blows forward; and, as those which are thrown down by the front of the tornado must fall first, they will, of course, be found, where there is any overlapping, *under* those which fall forwards."

On comparing this description with the track at New Harmony, Fig. 2, we find the phenomena there represented totally at variance with it; on the north side of the path, adjoining the S. W. corner of Schnee's fence, there are numbers of trees prostrated to the north, and directly *outwards* from the centre of the path; the same thing occurs in many places on both the north and south sides of the path. In the centre of the path there are trees lying at right angles to the course of the tornado; and those trees, which Mr. Espy describes as being thrown down by the meteor where the wind blows backwards, in many cases lie *over* instead of *under* those that fall forwards; this will be seen by examining the groups of crossed trees where they are numbered, the lowest number indicating the undermost, and the highest number the uppermost prostration.

Seeing these discrepancies, we cannot wonder that Professor Loomis, when he witnessed at Mayfield, phenomena similar to those of the New Harmony tornado, should come to the conclusion that the wind in tornadoes blows round, and to the same point at one and the same time, each motion "well nigh masking the other." Yet I think if he had plotted those trees, of which he took the bearings, instead of calculating their mean numerical values, he would hardly have come to the conclusion that the Mayfield tornado was a whirlwind, rotating in the direction west, north, east; for his examples show that the rotation could be neither in one direction nor the other.

It is owing, I think, to the want of an accurate and sufficiently extensive description of the track of a tornado that the rotatory hypothesis prevails, for I believe there is nothing in the phenomena at New Harmony that cannot be explained by that of the ascending column. It does not appear to me to be inconsistent with this theory to suppose a tree on the margin of the track to be as likely to be prostrated *outwards* from, as *inwards* to, the centre of the path. Let *K K*, and *M M* (Fig. I), represent the right and left margin, and *L L*, the axis,

Fig. I.



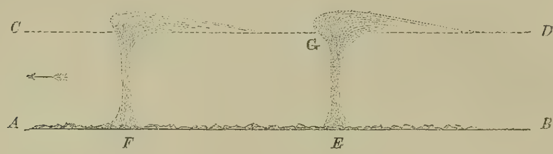
of the track of a tornado; suppose the track to be one mile wide. Let *H* be a tree standing near the left margin; let *A* represent the bottom of the ascending column, and the radii the afflux of air to the focal area; let this focal area have a progressive motion from *A* to *G*, at the rate of one mile per minute. When the centre of the tornado is at *A*, it will be about four miles distant from *H;* consequently *H* will receive the wind in the direction from *A;* in one and a half minutes the centre will have advanced to *B*, and *H* will receive the wind from *b;* as the tornado approaches, the force of the wind increases, and in another minute and a half the centre will have reached *C*, and *H* will receive the wind from *c;* in the next minute the centre will reach *D*, the wind will have reached its maximum force, *H* will receive the wind from *d;* the wind in the last minute having veered, with increasing rapidity, sixty degrees; this is continued for another minute, until the centre reaches *E*, when *H* will have the wind from *e;* in the last one and a half minutes the wind has veered, with maximum velocity, from N. E. to N. W.; and, during this rapid change, and greatly increased velocity, is it unlikely that, as the tree is successively swayed round, the force of the wind should at this moment be such as to prostrate the tree directly outwards, with the top of the stem at right angles to the centre of the path? This I think highly probable; and the prostrated trees show, more or less, that where they had the power to withstand the first impulse of the wind, they have been successively swayed round; this mode of action may be traced from one margin of the track to the other. Figs. 7, 8, 9, of the map, are illustrative of these points. Fig. 7 is a view near the north margin of the track, adjoining the S. W. corner of Mr. Schnee's fence, looking east; the trees are prostrated nearly due north, and exhibit the appearance of being suddenly twisted, and thrown outwards from the centre of the path, as described.

Fig. 8 is a sketch near the centre of the track, looking S. W.; here is a tree prostrated from the N. W., interlocked in the forks of one prostrated from the S. E., with three trees lying between them from the S. W., most clearly evidencing the simultaneous overthrow from opposite points. The tree in the front, in a northerly direction, and the illustration in Fig. 9, are further examples of the swaying round and twisting of trees. It is taken from near the centre of the track.

Another illustration in favor of the hypothesis of an ascending column, may be drawn, I think, from the barometrical observations made at New Harmony. It will be observed that the barometer fell half an inch from April 27 to the day of the storm, April 30. This fall was so gentle that it did not on any of those days mask the 9 A. M. maximum horary oscillation, and it may therefore be inferred that the disturbing cause was distant. At 3 P. M., on the day of the storm, one hour and a half previous to the tornado passing the meridian of New Harmony, the height of the mercury in the barometer was 29.090 inches; at 4.30 P. M., at the time of the passage of the tornado, it was 29.170; and at 6 P. M., one hour and a half after the passage, it was 29.090. This sudden rise and fall of 0.80 of an inch at the time, which is usually that of the minimum horary oscillation, is remarkable, and we may attribute it to the local action of the tornado, and account for it by Espy's hypothesis, as explained in the following paragraph.

Let *A B*, Fig. II, represent the track of a tornado, the dotted line *C D* the height or weight of the atmosphere at New Harmony, at 3 P. M., and at 6 P. M., one

Fig. II.



being one hour and a half previous, the other one hour and a half subsequent, to the passage of the tornado. Imagine *E G* to represent Espy's ascending column of air, with horizontal conflux at the base from the surrounding space; suppose the column to reach the top of the atmosphere, *C D*, and the air in the ascending column to be spreading out and overlapping the air in the surrounding regions, in the vicinity of the tornado, and by increasing the weight of the air around, causing the barometer to rise. Suppose *E* to be the meridian of New Harmony, over which the column, or tornado, is passing. Suppose *F* to be the meridian of Leavenworth, and that *F* is ninety miles distant from *E*, and now imagine the column in motion, and progressing towards *F* at the rate of a mile per minute; and that after an interval of one and a half hours, it has reached *F*. During this progress of the column we may conceive the translation of an atmospheric wave, and as the meteor passes on towards Leavenworth, we may imagine the gradual flowing away of the air, and the restoration of the equilibrium of the atmosphere to the degree that existed previous to the coming up of the meteor, or disturbing cause.

In conclusion, in referring to the different causes from which it is said tornadoes originate, my opinion is that the phenomena are incompatible with the rotatory hypothesis; and this opinion is strengthened by my inability to conceive, how any deflection of trade-winds by mountains, or action on the air by the different rotative velocity of the earth's surface, can originate these meteors: I cannot conceive the probability of the bodily rising, on a particular point of the intertropical plain of America, of an intensely heated column of air, with an ascensional force sufficient to carry it into the upper strata of the atmosphere, with the full westerly energy derived from the earth's rotative velocity; producing in its course a ripple, which, on its return, strikes far below into the lower current, creating the necessary condition of a rotatory storm, in which a mass of air, animated with immense velocity, forces its way through an atmosphere, either at rest, or moving in an opposite direction, creating vortices, subsisting and wandering over great tracks, long after the original impulse is withdrawn; I cannot conceive, whatever may be the velocity originally communicated to any body of air, how at 800 miles distance from the tropic, it could still have the power to subsist, and, without further support, have energy sufficient to continue its destructive career for 250 miles, tearing down trees at the rate of 7,000 on a mile, per minute.

Though I am inclined to believe in Professor Espy's idea of an ascensional column, of its origin, whether derived from the condensation of vapor, as affirmed by Espy, or from electrical action, as contended for by Dr. Hare, I do not offer an opinion. I chiefly desire that the contribution I here present may be useful in the establishment of correct opinions as to the mode of action in tornadoes, and to assist by facts any who are seeking to penetrate those depths obscure, in which the origin of meteorological phenomena are buried.

EXPLANATION OF THE QUARTO PLATE.

THE opposite quarto plate is intended to represent a group of trees, on the track of the tornado, about three hundred yards a little west of south of the five mile post on the New Harmony Plank Road. It is another view of the group represented in Fig. 8 of the map; that view is taken from the bottom of the hollow looking southwest: this one is taken from the top of the hill looking northeast to the side of the opposite hill.

The tree in front, parallel with the bottom of the picture, and marked No. 1, in the ground plan below, is the undermost tree, and was prostrated from the southeast. Nos. 2 and 3, in the plan, prostrated from the south-southwest, lie to the right out of the picture; they are shown in Fig. 8 of the map. The tree twisted off near the right margin, marked No. 4, in the plan, is from the southwest. The tree in the front of the picture, at the bottom, marked No. 5, in the plan, is from nearly west. Nos. 2, 3, 4, and 5 lie over No. 1. No. 6, in the plan, from the northwest, is the tree interlocked in the forks of No. 1, and overlying all the others; exhibiting the remarkable peculiarity of a southeasterly interlocked in a northwesterly prostration, and having four westerly and southwesterly prostrations between them.

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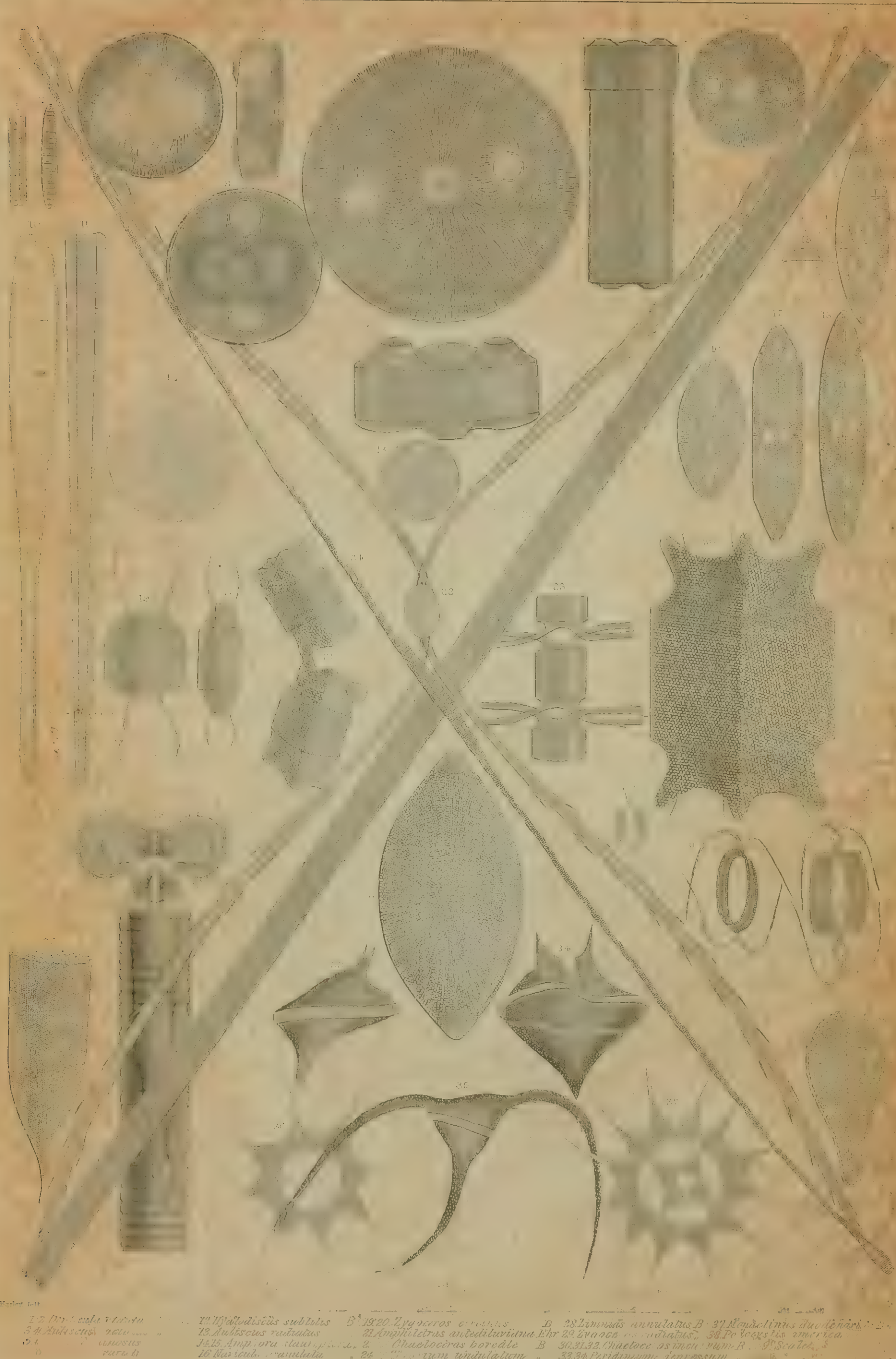
WASHINGTON, D. C.

APRIL, 1855.

GROUP OF TREES PROSTRATED BY THE NEW HARMONY TORNADO.

MICROSCOPIC FORMS



W. Bailey del.

1. 2. Pin. cula . lata
3. 4. Aulacus . rata ..
5. 6. . anosus
8. vara b
. vrindlatus
10. 11. Climacosph eniu elongatu h B.
12. Hyalodiscus subtilis B.
13. Aulacus radiatus
14. 15. Amphiora . ta .. .
16. Navicul. . anulata
17. Staur. . oblonga
18. aspera Ehr.
19. 20. Zygoceros . B.
21. Amphitetras antediluviana Ehr.
2. Chaetoceras boreale B.
24. . um undulatum "
26. Tricer. tium setigerum "
27. Cothurnia? . lepida "
28. Limnias annulatus B.
29. Evanoa . ndiatus "
30. 31. 32. Chaetoce. as incu . rum B.
33. 34. Peridinium depressum "
35. longip.
36. Monactinus octonarius
37. Monactinus duodenari.
38. Pe . locys tis america
9. Scales.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

NOTES

ON

NEW SPECIES AND LOCALITIES

OF

MICROSCOPICAL ORGANISMS.

BY

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[ACCEPTED FOR PUBLICATION, NOVEMBER, 1853.]

VOL. VII.

COMMISSION

TO WHICH THIS PAPER HAS BEEN REFERRED.

Prof. C. R. Gilman, M. D.,
College of Physicians and Surgeons, New York.

Waldo I. Burnett, M. D.,
Boston.

Joseph Henry,
Secretary S. I.

NOTES ON NEW AMERICAN SPECIES AND LOCALITIES

OF

MICROSCOPIC ORGANISMS.

I.

Fossil Marine Diatomaceae in California.

In examining, at the request of Dr. J. R. Chilton, of New York, some specimens of earthy minerals which were collected in California by Washington Chilton, Esq., I found one highly interesting specimen resembling a white clay, which the microscope proved to be almost entirely composed of fossil marine species of Diatomaceae.

The specimen was from Suisun Bay, twenty-five or thirty miles above San Francisco, California, where Mr. Chilton says a large deposit of a similar character occurs. This is the first locality of fossil marine *Diatomaceae* which has been detected on the Pacific side of this Continent. It abounds in numerous species of *Coscinodisci, Actinocycli, Actinoptychi, Mastogonia*, &c. which I cannot distinguish from the common species in the "infusorial strata" of Maryland and Virginia.

The predominant species, however, which forms a large portion of the mass, is a minute silicious shell which I believe to be undescribed, and which appears most nearly allied to some of the species of Kützing's genus *Denticula;* I shall refer to it as *Denticula lauta*, B. (See Plate, Figs. 1, 2, and description, page 9.) Among the other species from this locality I recognized the following, which also occur fossil at Richmond, Virginia, viz: *Coscinodiscus radiatus, C. lineatus, C. oculus-iridis, C. gemmifer, Pyxidicula cruciata*, and *Dictyocha fibula* of Ehrenberg, while no trace was found of other characteristic forms of the Virginian deposits, such as the *Gallionella sulcata, Zygoceros rhombus, Denticella tridentata, Goniothecium Rogersii, Eupodisci*, &c. of Ehrenberg. The Californian deposit also appears to be entirely free from any Polythalamian shells.

Should this notice meet the eye of any scientific traveller in California, it may induce him to furnish further information concerning the geological relations of this interesting deposit, and to collect a good supply of specimens for a more complete study.

II.

New Species of Limnias.

Limnias annulatus, B.

(Plate, Fig. 28.)

Case of the animal having numerous transverse rings.

In searching, in various parts of the United States, for Desmidieae, my attention was long ago drawn to the frequent occurrence in lakes, ponds, &c. of short cylindrical membranaceous tubes, closed at one end and marked with rings so as to resemble the trachea of insects.

The real nature of these bodies remained unknown to me until the summer of 1851, when I detected great numbers of similar forms attached to various aquatic plants in pools near West Point, and found them to be the cases of a species of Limnias, not noticed in books prior to the publication of Pritchard's *Infusorial Animalcules*, second edition in 1852, where may be found, on page 619, the following description:—

"Limnias ———? appears to be a distinct species which I do not find described. The case is ribbed and semi-transparent, and is composed of a series of lateral rings, found in a ditch near Witlingham, Norwich, on duck-weed (Brightwell)."

This description leaves no doubt that the species referred to by Pritchard is the same as our own, and as he has refrained from giving it a specific name, I propose to call it *L. annulatus*. It is the only species which I have yet noticed in the United States, and occurs in vast numbers at West Point, New York, where I have found large plants, such as *Ludwigia palustris*, literally covered with the brown cases of these animals; affording, when the animals, with their rotatory organs, were protruded, an exceedingly beautiful spectacle when moderately magnified. Our figure is only intended to show the form and markings of the case, with the *general* appearance of the animal, the details of the latter being reserved for further study.

III.

New Species of Ehrenberg's Genus Auliscus.

The generic characters, as given by Ehrenberg, for the genus *Auliscus* are as follows:—

"Lorica bivalve, cylindrical (or orbicular), multiplying by perfect self-division; two large (not tubular) apertures on each surface of the disk laterally, which also is not cirrhose. This genus differs from *Cerataulus* in wanting the cirrhose surface of the lateral disks, as also the tubular apertures." (See *Pritchard's Infusoria*, second edition, page 320.)

Although it has long been known to me that, in most if not all of the cases where Ehrenberg attributes apertures to the shells of Diatomaceae, no real perforations of the shell exist, I yet failed to perceive, until quite recently, that to the genus *Auliscus* are probably referable a number of beautiful forms, for which I had intended to propose a new genus with the name of *Mastodiscus*. I am, however,

now pretty certain that Ehrenberg's *Aulisci* have no apertures, and that, by correcting his description as follows, it will include the beautiful forms represented in our figures 3, 4, 5, 6, 7, 8, 9, and 13. The *Eupodiscus sculptus*, Smith, *British Diatomaceae*, p. 25, also belongs to this genus.

AULISCUS.—Ehrenberg.

Lorica cylindrical (often discoid); bases[1] circular, undulated, having two circular, flattened, mastoid, imperforate processes at some distance from the margin; umbilicus (generally present) smooth, circular, surrounded by a plumose arrangement of dots and lines; sides smooth. The projections on one base are usually on a line at right angles to that on which those of the opposite base are placed.

The following species appear to belong here, and are, I believe, entirely new.

1. Auliscus pruinosus, B.

(Plate, Figs. 5, 6, 7, and 8.)

Lorica large; edges bevelled; bases marked with four sets of curved and sparsely punctate lines, two sets of which diverge from the circumference of the large smooth umbilicus, while the other two sets converge around each of the two large mastoid processes. Sides smooth, or with distant lines parallel to the base. Diameter from $\frac{2}{1000}$th ($= 2^m$) to $\frac{6}{1000}$th ($= 6^m$) of an English inch.[2] This species occurs in estuaries, &c. from Massachusetts to the Gulf of Mexico. I found it particularly abundant at Ballast Point, Tampa Bay, Florida. It occurs in the Hudson River at West Point, and in the earth of rice fields in Georgia and South Carolina.

This species, when of largest diameter, is usually of a flattened or discoid form, as in Figs. 5 and 6; but when smaller, it presents considerable variety in the length of its sides, sometimes being discoid, as in Fig. 6, and not unfrequently showing long cylindrical sides marked by numerous distant lines, parallel to the base, as in Fig. 7. Specimens frequently occur in which the sides show two or more cylindrical portions differing considerably in diameter, as in Fig. 7. These varieties all occur together, and pass into each other by such gradations that I am satisfied they should all be referred to the same species.

2. Auliscus punctatus, B.

(Plate, Fig. 9.)

Lorica, as in the preceding species, but having the lines so crowded and so closely punctate that the plumose arrangement is scarcely visible.

---

[1] In this paper, the term base is applied nearly in its geometrical sense to the circular or elliptical ends of cylindrical forms; to the triangular, quadrangular, or curved ends of *Triceratium*, *Amphitetras*, *Zygoceros*, &c.; and, in the Naviculaceae and allied forms, the term base will be applied to the striated, grooved, or punctate surfaces on which the thickened portions usually, but erroneously called, apertures exist. That the so-called apertures in *Navicula*, *Pinnularia*, *Stauroneis*, &c. are, in reality, the thickest parts of the shell, I proved, some time since, by the action of hydrofluoric acid in which these portions are the last to dissolve. (See *Silliman's Journal*, 2d series, XI. 349.)

[2] All dimensions in this paper will be given in thousandths of an English inch, so as to have the same unit of comparison for all the figures. The small m attached to a number will be used as a symbol for $\frac{1}{1000}$th of an inch, thus: $6^m = \frac{6}{1000}$ths.

This may prove to be only a variety of the preceding, with which it often occurs at the above-mentioned localities, but, at present, I think it best to keep them separate. The sparsely punctate bases of the one, and the closely punctate surface of the other appear to offer a sufficient distinction between them.

3. Auliscus caelatus, B.

(Plate, Figs. 3, 4.)

Margin of the bases strongly grooved with unequal lines proceeding from the circumference towards the centre, but leaving a well-defined cruciform figure, containing on one bar the two processes with sets of converging curves, and on the other bar two sets of beautifully reticulated and anastomosing lines. Umbilicus distinct, smooth. Diameter of base $\frac{3}{1000}$th in. Found in sand washed from West India sponge, and in soundings from Mobile Bay.

4. Auliscus radiatus, B.

(Plate, Fig. 13.)

Lorica small; bases with radiant punctate lines; umbilicus wanting. Diameter $\frac{2}{1000}$th to $\frac{3}{1000}$th. A minute species, presenting the characteristic mastoid processes of the genus *Auliscus*, but having no distinct umbilicus, and only slight indications of the peculiar curved lines of the preceding species. Found in mud from New York Harbor, and in the mud of the Hudson River at West Point; also at Rockaway, Long Island, New York.

IV.

American Locality of Amphitetras antediluviana, Ehr.

I have published, in the *American Journal of Science*, notices of American localities of the beautiful species of *Isthmia* and *Biddulphia*, but I had long sought in vain for the allied but much rarer form of *Amphitetras antediluviana*, which has never hitherto been noticed as an American species. I have at last, however, detected a few frustules of this species (See Plate, Fig. 21) in soundings from Edgartown Harbor, Massachusetts, for which I am indebted to A. D. Bache, Esq., Superintendent of the Coast Survey. I presume that a careful search among the parasites upon the Algae in the vicinity of Edgartown would be rewarded by the discovery of an abundance of specimens of this interesting species.

In company with the above, at Edgartown Harbor, and at the outer buoy near Cape Pogue, were found the following Diatomaceae :—

Viz: Actinoptychus senarius, Ehr. Amphora libyca, Ehr.
Biddulphia pulchella, Gray. Gallionella sulcata, Ehr.
Eupodisci with from three to seven feet, and always opaque and white; perhaps new.
Auliscus pruinosus, B. Auliscus punctatus, B.
Navicula? lyra, Ehr., abundant. Triceratium favus, Ehr., very abundant.

This locality is also remarkable for the abundance of Polythalamian forms, among which (besides various species of *Textilaria* and the common nautiloid forms) were noticed beautiful species of a *Lagena*, resembling the *L. laevis* of Wil-

liamson,[1] and numerous specimens of an *Entosolenia*, resembling the *E. globosa* of Williamson, which is abundant in a fossil state in the Miocene tertiary of Virginia, and which appears to be a cosmopolite in the present seas, as I have found it not only in American soundings, from Massachusetts to the Gulf of Mexico, but also in muds from the Island of St. Helena, and from Bombay.

No locality on our northern coast has furnished such an abundance of Polythalamian forms as the one at Edgartown; and it is worthy of inquiry whether oceanic currents, or some peculiarity of the neighboring rocks, can have affected the fauna of this place.

V.

American Localities of Tetragramma.

In the *Berlin Monatsbericht* for May, 1843, Ehrenberg gives the following characters for the genus *Tetragramma*:—

"Genus e familia Bacillariorum, sectione Naviculaceorum. Lorica, simplex bivalvis silicea, compressa quadrata libera latior quam longa unilocularis, septis in medio loculo binis medio interruptis ibique dilatis in forman 4 signorum musicorum."

He states also that the only species known to him is nearest allied to the *Terpsinoe musica*.

The specific characters of the Asiatic species, *T. Asiatica*, Ehr., are not given, nor have I seen any drawing or specimens of it. The generic characters, however, as above given, agree so well with an American form, that I have no doubt that we have a species of the genus occurring in considerable abundance upon the North American coast of the Atlantic.

As the Asiatic species is unknown to me, I shall, for the present, keep our species distinct from it, and propose for it the name *Tetragramma americana*, and the following specific characters:—

Tetragramma americana, B.

Lorica quadrangular, resembling that of *Terpsinoe musica*, Ehr., but smaller, more minutely punctate, and showing on each side only two of the internal bodies, resembling notes of music. The end view shows an undulating outline (see Fig. 1, A B), with two cross-bars, which separate the inflated central portion from the narrower three-lobed ends. By comparing the outline (Fig. 1, A, B) of *T. americana* with the accompanying ones (Fig. 2, C D), of *Terpsinoe musica*, their chief points of resemblance and disagreement will be seen.

Fig. 1.

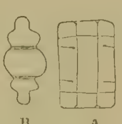
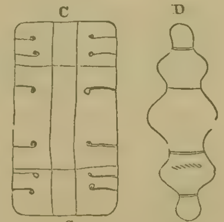


Fig. 2.



[1] See Annals and Magazine of Natural History, 2d series (Plate I. Fig. 1), for January, 1848.

Single frustules of *Tetragramma americana* were found by me several years ago in the mud of the Hudson River, in mud from Rockaway, New York, and Charleston, South Carolina; but I have nowhere found it in such abundance as in the mud of the St. Sebastian River near St. Augustine, Florida, and at Tampa Bay, Florida.

VI.

New Species of Diatomaceae.

In this article I present brief descriptions, with figures of a number of American Diatomaceae, which I suppose to be hitherto undescribed.

1. Amphora stauroptera, B.

(Plate, Figs. 14, 15.)

Elliptical, elongated; margins striated; central portion crossed, as in *Stauroptera*, by a broad band. Length, $\frac{4}{1000}$th; width at the middle, a little more than $\frac{1}{1000}$th of an inch. Found in Algae from Halifax, Nova Scotia.

2. Climacosphaenia elongata, B.

(Plate, Figs. 10, 11.)

Frustules elongated clavate, rounded at the ends, and having numerous cross-bars on the minutely striated bases. Striae most distinct near the edges, and exceedingly delicate in the middle portions of the bases. Pedicels long, branching, supporting many fan-shaped groups of frustules, as shown in the following wood-cut. It occurs in great numbers, parasitic upon Algae; from Garden Key (Tortugas), Florida. Length of frustules, $\frac{13}{1000}$th of an inch.

Fig. 3.

I have distributed some specimens of this form under the manuscript name of *C. ramosa*, B.; but, as I now believe that branched pedicels may also belong to other species, I have changed the name, and now rely on the elongated clavate form of the frustules, and their excessively minute striations, to distinguish this species from those described by Ehrenberg and Kützing. The striae on the *C. elongata* can be made out without much difficulty, near the edges of the shell, but to trace them completely across the middle regions of the bases requires excellent lenses and careful management of the light. In fact, these lines are even finer than those upon the Providence *Grammatophora*. In our figure 10, these cross-lines are well represented, although the figure itself almost requires to be looked at with a magnifying glass, in order to distinguish these lines.

Chaetoceros boreale, B.

(Plate, Figs. 22, 23.)

Body oblong in side view, elliptical when seen endwise. Horns excessively long (30 to 50 times as long as the body), and armed with numerous minute spines. Longest diameter of the body $1\frac{1}{4}^{m}$. Shortest diameter $\frac{3}{4}^{m}$. Length of the horns 16^{m}. Length of the spines 1^{m}. Habitat, St. George's Bank, Atlantic Ocean.

Ehrenberg describes several recent species of *Chaetoceros*, as occurring in the

Southern and Antarctic Oceans. Other species are common in Guano, and others occur as fossils in the "Bermuda Tripoli," and in the infusorial strata at Richmond, Virginia. The species here described was found in considerable numbers with other Diatomaceae in the contents of the stomach of the *Botryodactyla grandis*, Ayres, a large Holothuridian animal from St. George's Bank, for specimens of which I am indebted to William O. Ayres, Esq., of Boston.

It is the first of the genus which has been found as a living species in the northern hemisphere. Its southern congeners abound in a frozen ocean.

Chaetoceros incurvum, B.

(PLATE, Figs. 30?, 31, 32.)

Bases elliptical; horns recurved, longer than the body. Frustules usually found united in pairs, with a void space between them. Sometimes a fillet with the curved horns is found unconnected with the other portions (see Fig. 31).

I have only noticed this curious form in the infusorial strata at Richmond, Virginia, where it is not rare.

Denticula? lauta, B.

(PLATE, Figs. 1, 2.)

Bases elongated, oblong or elliptical, with three to sixteen distant transverse striae, or bars, which pass on to the sides, where they terminate in an ocellate form. Sides rectangular, showing near each margin a row of the ocellate ends of the basal striae or bars. Length, 2^{m}; width, $\frac{1}{4}^{m}$.

This species forms a large portion of the mass of fossil Diatomaceae at Suisun Bay, California.

Gallionella crotonensis, B.

(Not figured.)

Frustules minute, about twice longer than broad, united by pairs into long filaments, and showing two sulci or lines of division between the ends of each pair. Internal portions not constricted. Surface with decussating rows of very minute granules. Bases of the frustules slightly crenulate. Average length of joints, $\frac{1}{2}^{m}$. Diameter, $\frac{1}{5}^{m}$. to $\frac{1}{3}^{m}$.

I should be very reluctant to add another species to this already confused and imperfectly known genus, if I could satisfactorily refer our species to any of the described forms. But it is only by overlooking characters which are obvious enough under good glasses, that I can make it appear to agree with any of the published descriptions.

It might at first be confounded with either *G. decussata*, *G. crenulata*, or with the young of *G. aurichalcea*, Ehr.; but, although decussately punctate, it differs from *G. decussata* in the extreme delicacy of its granulations; although crenulate, it is far less distinctly so than *G. crenulata*, and from *G. aurichalcea*, for the young of which it is usually mistaken; it differs in the small and nearly uniform size, its want of internal constrictions, and in its surface appearing distinctly decussately-punctate under a power which shows scarcely a trace of granulations on the surface of *G. aurichalcea*.

2

The *Gallionella crotonensis* constitutes the largest portion of the matter collected by filters from the Croton water in the city of New York, and thousands of its frustules must be daily swallowed by those who use the unfiltered water. It is so abundant in the Croton water that it may yet possibly prove of importance as a means of detecting the fraudulent dilution of various substances. A portion of the sediment from a suspected liquid could be taken up with a sucking tube, and then examined with the microscope, when the *G. crotonensis*, and other characteristic forms, would easily be recognized. (See Article VII.)

Hyalodiscus subtilis, B.

(PLATE, Fig. 12.)

Discoid, bases with a broad margin, marked like the engine-turned back of a watch, with lines of exceeding delicacy, only visible by the highest magnifiers and careful illumination. Umbilical portion more coarsely granulated, and in size little less than one-third of the diameter of the base. Diameter from 1^m. to 3^m.

Occurs at Halifax, Nova Scotia.

Ehrenberg's species, *H. laevis*, resembles the *H. subtilis* in many respects, but differs in having a wider margin, covered with much coarser markings. The Halifax specimens, even of the largest size, are so delicately marked as to form admirable test objects for the best microscopic objectives. (See page 14.)

Hyalodiscus stelliger, B.

(Not figured.)

Discoid, bases with a broad margin, covered with distinct rectilinear rows of dots, arranged in sectoral groups, so as to produce a stellate appearance.

Abundant at St. Augustine, Florida.

The markings in this species are quite distinct, and the stellate appearance, resembling that shown by *Coscinodiscus subtilis*, will at once distinguish it from all other species.

Naviculata granulata, B.

(PLATE, Fig. 16.)

Bases elliptical, with a smooth longitudinal space reaching from end to end, exterior to which is a coarsely and irregularly granulated portion, bounded by marginal rows of dots or granules. Length, 3^m. Width, $1\frac{1}{2}^m$.

Habitat, Halifax, Nova Scotia.

Stauroptera oblonga, B.

(PLATE, Fig. 17.)

Lorica, having the size and markings of *Stauroptera aspera*, Ehr., but having its bases oblong, with parallel sides and acute angular ends.

Found with *S. aspera* at Halifax, Nova Scotia. For the purpose of comparison, a figure of *S. aspera*, Ehr., is given. (See Plate, Fig. 18.)

Podocystis americana, B.
(PLATE, Fig. 38.)

Lorica nearly sessile; bases obovate, with a longitudinal line through the middle, and numerous granules arranged in double rows, producing more or less regular transverse bars. The side view is wedge-shaped. Length, $\frac{4}{1000}$th of an inch, $= 4^{m}$.

This very pretty species is not uncommon as a parasite upon filamentous Algae in Long Island Sound, and at Greenport, New York.

Tetragramma americana, B. (See page 7.)

Toxarium undulatum, B. (See page 15.)

Triceratium setigerum, B.
(PLATE, Fig. 24.)

Bases triangular, slightly convex with rounded edges, and bearing three large obtuse projections, or horns, at the base of each of which is placed a setiform process. Sides rectangular or square, separated from the ends by deep constrictions. The whole surface covered with granules arranged in a decussate manner. Length from base to base, 6^{m}. Width of sides, 3^{m}. to 4^{m}.

This very beautiful species occurs at Ballast Point, Tampa Bay, Florida, where it is not rare. It appears to be allied to the *Triceratium spinosum*, B., which I found fossil at Petersburg, Virginia. (See *London Physiological Journal*, I. 143.

Zygoceros circinus, B.
(PLATE, Figs. 19, 20.)

Bases elliptical, terminating in truncated cones without horns, but having two long, setiform, bent spines. Sides, minutely and decussately punctate. The decussating rows of granules are omitted in the figure.

Fossil at Richmond, Virginia.

Zygoceros? radiatus, B.
(PLATE, Fig. 29.)

Base with an elliptical outline; horns slightly elevated, minutely punctate; basal surface covered with radiating and dichotomous rows of granules; sides not yet seen. Length of base about 7^{m}. of an inch. Width about 4^{m}.

Although I have only seen a few of the bases of this elegant species, I have little doubt that it is a congener of *Zygoceros rhombus*, Ehr. Its large size and beautiful markings make it a very interesting species. I found it among Algae from Halifax, Nova Scotia.

VII.

ON THE MICROSCOPIC FORMS FOUND IN THE CROTON WATER IN NEW YORK CITY.

It has long been known to the New York microscopists, but not to the public generally, that the Croton water abounds in beautiful microscopic organisms, and particularly in Diatomaceae and Desmidieae. The following list gives the names

of the species noticed by myself in sediment collected from the Croton water by means of a filter at the Astor House, in New York city:—

DIATOMACEAE.

Amphiprora alata, Ehr.
Amphora ovalis, Ehr.
Cocconema cymbiforme, Ehr.
" gibbum, Ehr.
Eunotia amphioxys, Ehr.
" gibba, Ehr.
Gallionella crotonensis, B.
" aurichalcea, Ehr.
Gomphonema acuminatum, Ehr.
" constrictum, Ehr.
Navicula affinis, Ehr.
" cuspidata, Ehr.
" inaequalis, Ehr.
" mesolepta, Ehr.
" (Gyrosigma) hippocampus, Hass.
" (Gyrosigma) Spencerii, B.
" (Pinnularia) dicephala, Ehr.
" (Pinnularia) elliptica, Ehr.
" (Pinnularia) peregrina.
Stauroneis gracilis, Ehr.
Stephanodiscus Niagarae, Ehr.
Surirella solea, Ehr.
Synedra acus, Ehr.
" capitata, Ehr.
" ulna, Ehr.
" valens, Ehr.
" vitrea, Kg.
Tabellaria flocculosa, Ehr.
" fenestralis, Ehr.

DESMIDIEAE.

Ankistrodesmus falcatus.
Closterium lunula.
Monactinus octonarius, B.
" duodenarius, B.
Pediastrum ellipticum.
" heptactis.
Pediastrum Napoleonis.
" pertusum.
" simplex.
" tetras.
Scenedesmus obliquus.
Scenedesmus obtusus.
" quadricaudatus.
Staurastrum dejectum.
" enorme.
" gracile.

INFUSORIA AND CRUSTACEA.

Cyclops, several species.
Lynceus, several species.
Cypris, several species.
Spicules of spongilla.
Anguillulae, &c.

VIII.

Two New Species of the Genus Peridinium.

1. Peridinium longipes, B.

(Plate, Fig. 35.)

Body triangular, rough; angles produced into very long ciliated processes, of which the two frontal ones are longest. Body crossed obliquely by a ciliated groove. Habitat, St. George's Bank.

This species is distinguished from *P. tripos,* of Ehrenberg, by its roughly granulated surface, its ciliated processes, and its triangular, not urceolate body.

Many specimens of this fine species were found in the stomach of the *Botryodactylis grandis,* Ayres, from St. George's Bank.

2. Peridinium depressum, B.

(Plate, Figs. 33, 34.)

Lorica obliquely depressed, with one large conical posterior process, and two smaller conical frontal processes; the latter separated by a deep notch. Surface granular and reticulated.

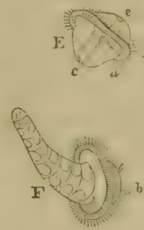
Habitat with the preceding.

Both of these species of *Peridinium* were doubtless furnished with a proboscis when living, and, like the other marine species of this genus, were probably phosphorescent.

The form of our species *P. depressum* (see Figs. 33, 34) is so analogous to the embryo of a *Nereis,* whose curious changes were studied by Loven, that I am induced to copy the figure and description of the latter, as given in Owen's *Lectures,* page 147.

He says: "Dr. Loven obtained, in August, from the Baltic Sea, a discoid animalcule (as in Fig. 4, E), which rapidly moved by means of two rows of vibratile ciliæ; the principal row being situated upon a projecting ring (b) at the margin of the disk. It had a mouth (a) and an anus (c) at the apex of the cone. The course of the alimentary canal was detected by feeding with indigo. In a short time, the cone began to elongate and to be divided into segments which were developed in four parts, the two principal pieces forming half rings, one on the upper, the other on the lower surface, which were united by two shorter lateral pieces. Coincident with this change was the development of a head from the discoid surface (e), upon which the black ocelli and then two pointed filaments or antennae (f) (Fig. 4, F) made their appearance. The length of the body and number of segments increased, the disk and cilia still existing. The disk is afterwards reduced to an appendage on each side of the head, and finally disappears. The new rings are added to the front of, and not behind the old ones. The tubular and setigerous feet are afterwards added."

Fig. 4.



This account, and particularly the comparison of the above figure with the form represented in the Plate, Figs. 33, 34, leads me to suspect that at least a portion of the forms which are now included in the genus *Peridinium,* may be imperfectly developed, or embryonic Annelids.

IX.

New Species of the Genus Cothurnia?

Cothurnia? perlepida, B.

(Plate, Fig. 27.)

Apex of the case attenuate, slightly curved; surface entirely covered with spiral decussating rows of hexagonal cells; orifice crenulate. Animal unknown.

Habitat, St. George's Bank and New Haven Harbor.

In order to give a name to the beautiful bodies above described, I have referred them, although with much hesitation, to the genus *Cothurnia,* to the cases of which they have much resemblance in shape. I have never found them in materials which have been acted upon by acids, although noticed prior to the action of the acid; which fact, added to the great transparency given to them by Canada Balsam, in which they become almost invisible, leads me to believe that they are membranaceous. Should they prove to be silicious, they might be referred to the genus *Rhizosolenia.* I have seen several specimens from St. George's Bank, and also one from the mud of the harbor of New Haven, Connecticut.

X.

American Species of the Genus Monactinus.

The genus Monactinus differs from *Pediastrum* of Meyen (*Micrasterias* of Ehrenberg), by having but one point or horn, instead of two, to each of the cells composing the circumference. Several forms belonging to this genus occur in the sediment filtered from the Croton water in New York, and those here described appear sufficiently constant in character to rank as species. As I cannot satisfactorily identify them with foreign species, I have ventured to give them names.

1. Monactinus octonarius, B.

(Plate, Fig. 36.)

Circumference composed of eight cells. Centre void.
Habitat: Croton water, New York city.

2. Monactinus duodenarius, B.

(Plate, Fig. 37.)

Circumference with twelve cells. Centre with three cells.
Habitat; Croton water, New York.

XI.

On some New Test Objects.

1. Much of the trouble experienced in resolving finely lined objects by oblique light, arises from the necessity for the lines to occupy certain favorable positions with regard to the light, which an unpractised observer may find it difficult to obtain. A test which shall remove this difficulty must be circular, with lines radiating in all directions, so as to require no displacement in order to get the most favorable illumination; for it is obvious that, on such a body, some portion will always be in the best possible position with regard to the light. A diatomaceous shell, which has lines thus arranged, and which at the same time presents dots and lines of sufficient delicacy, is the *Hyalodiscus subtilis*, B. (Plate, Fig. 12) from Halifax, Nova Scotia. The largest disks are as finely marked as the Greenport *Grammatophora*, while the smallest specimens are not easier to resolve than the *Grammatophora subtilissima*, B. from Providence, Rhode Island. It is probable that these Hyalodisci may be found in considerable numbers on our northern coasts, and if so, they will prove admirable test objects.

2. A test object, which is even more difficult to resolve than either Amici's test or the Providence *Grammatophora*, is presented by what appears to be a variety of Ehrenberg's *Grammatophora stricta* from Halifax. Lenses which easily resolved the two tests above mentioned, entirely failed to resolve the Halifax specimens, which only yielded to some new objectives ($\frac{1}{12}$ths) made by Spencer.

I should here state that, in the spring of 1853, I resolved the Greenport *Grammatophora* unmistakably by a $\frac{1}{8}$th of an inch objective made by Spencer, and subsequently by a $\frac{1}{8}$th recently made by Powell, of London, for Dr. Vanarsdale of New York. Mr. Spencer informs me that, since the above observations were made, he has greatly improved his objectives, so that his $\frac{1}{8}$ths will readily resolve the Greenport *Grammatophora*.

XII.

Marine Diatomaceae of Halifax, Nova Scotia.

As no observations have been recorded upon the marine Diatomaceae of Nova Scotia, I take pleasure in presenting the following list of species found in mud washed from Algae from the harbor of Halifax, N. S., viz :—

Actinoptychus senarius, Ehr.
Amphiprora constricta, Ehr.
Amphora stauroptera, B. Plate, Figs. 14, 15.
Bacillaria paradoxa, Ehr. (abundant).
Cocconeis scutellum, Ehr.
Coscinodiscus (several species).
Dictyocha fibula, Ehr.
Dictyocha speculum, Ehr.
Diploneis entomon, Ehr.
Diploneis didyma, Ehr.
Gomphonema minutissima, Ehr.
Grammatophora serpentina, Ehr.
" stricta, Ehr.
Hyalodiscus subtilis, B. Plate, Fig. 12.
Navicula (Gyrosigma) sigma, Ehr.
" " elongata, Ehr.
" " formosa.
" granulata, B. Plate, Fig. 16.
" (Pinnularia) elliptica, Ehr.
" " lyra, Ehr.
" " peregrina, Ehr.
" " (several undetermined species).
Rhabdonema arcuatum, Kg.
Stauroptera aspera, Ehr.
" oblonga, B. Plate, Fig. 17.
Synedra sigma, Ehr.

XIII.

New Genus of Diatomaceae.

Toxarium, Bailey.

Lorica very long and slender; bases with an undulating outline, swollen in the middle, and then contracted into two excessively elongated processes with enlarged and rounded ends. Sides with nearly straight parallel edges. Bases transversely striate. The sides show the ends of the basal striae.

Toxarium undulatum, B.

Plate, Figs. 24, 25.

Syn. *Synedra undulata*, B. ms. and specimens.

This interesting species, the only one of its genus now known, was found by me several years ago, attached in considerable numbers to *Sargassum vulgare*, in Narragansett Bay. I distributed specimens under the name of *Synedra undulata*, B., but I now think it should form the type of a new genus, characterized as above.

The length of *T. undulata* is about 35m., its width at the middle of the base is about $\frac{1}{3}$m., and the width of the narrow parts of the base is about $\frac{1}{8}$m.

Habitat: Narragansett Bay, R. I., and Peconic Bay, near Greenport, New York. At both localities it was found parasitic, like a *Synedra* upon *Sargassum vulgare*.

XIV.

I cannot close this paper without expressing my thanks to Mr. J. E. Gavit, of Albany, the engraver of the Plate. Whatever faults the figures may present are due to me; for Mr. Gavit has, with untiring patience, industry, and zeal, endeavored to make the Plate as perfect as possible. The figures 5, 12, 26, and 27, are particularly beautiful. Figures 10 and 12 really need a magnifier to see their details.

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PUBLISHED BY THE SMITHSONIAN INSTITUTION,

WASHINGTON, D. C.

FEBRUARY, 1854.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

THE

ANTIQUITIES OF WISCONSIN,

AS

SURVEYED AND DESCRIBED.

BY

I. A. LAPHAM,
CIVIL ENGINEER, ETC.,

ON BEHALF OF THE AMERICAN ANTIQUARIAN SOCIETY.

[ACCEPTED FOR PUBLICATION, DECEMBER, 1853.]

PUBLISHED BY THE SMITHSONIAN INSTITUTION,

WASHINGTON, D. C.

JUNE, 1855.

T. K. AND P. G. COLLINS, PRINTERS,
PHILADELPHIA.

NOTICE.

The systematic exploration of the ancient remains of Wisconsin, of which the present memoir by Mr. Lapham is the result, was undertaken and accomplished by him on behalf of the American Antiquarian Society, from whose funds the necessary expenses were provided. Beyond these expenses Mr. Lapham desired and received no other compensation than the scientific enjoyment which the prosecution of the work itself afforded him.

It happened that, while these explorations were in progress, contributions from other persons relating to the earthworks of the same region were proffered to the Smithsonian Institution, whose publications in that department of American research already embraced the known antiquities of most other sections of the United States. On that account it seemed desirable that the two institutions should co-operate, and that the materials collected should be presented to the world through the same channel, and in the same style of illustration.

The suggestion was therefore made by the Smithsonian Institution to the Antiquarian Society, that, when Mr. Lapham's notes and drawings had been revised and sanctioned by the latter, the care and cost of printing the report should be assumed by the Institution. The proposition was readily acceded to, as better subserving the interests of science, since it would enable the Society to employ its funds in other researches.

In conformity with this understanding, the memoir, after having been carefully examined by a Committee of the Antiquarian Society, was submitted to the Smithsonian Institution, and accepted for publication.

Owing to the great expense attendant upon the issue of a work containing so many illustrations, the publication has been somewhat delayed. This has, however, allowed a number of important additions and corrections to be made—giving to the work still greater value as an accurate and faithful record of the interesting earthworks of Wisconsin, which are so soon to be obliterated by the march of improvement.

JOSEPH HENRY,
Secretary S. I.

Smithsonian Institution, June 1, 1855.

PREFACE.

Although the existence of aboriginal earthworks in the Western country has been known for almost a century, no mounds of imitative design intended to represent animal figures were observed, until a very recent period, when the territory now constituting the State of Wisconsin began to attract the attention of emigrants. This was in the year 1836, and I then made known through the newspapers of the day the fact of the existence of the "turtle-mound" at Prairie Village, now Waukesha, and of other animal effigies at various places. Since that time every opportunity has been embraced to make examinations and surveys of these highly interesting relics of the past, which have been thus not unfrequently saved from oblivion. In some instances, they were destroyed immediately or within a few days after my survey.

The American Antiquarian Society having placed at my disposal the means of paying the actual travelling and other expenses, these investigations were greatly extended; and the results are now presented, in the hope that they may have their use in the settlement of many archæological and ethnological questions of great interest and importance.

But little effort has been made to construct hypotheses in explanation of the facts observed, or by an extended comparison with the results recorded by others, to arrive at general conclusions. The want of extensive collections of books and other facilities at the West may long prevent our inquirers, here, from entering upon such speculations.

My office has been faithfully to fulfil the duties of the surveyor: to examine and investigate the facts, and to report them as much in detail as may be necessary; leaving it to others with better opportunities, to compare them, and to establish, in connection with other means of information, such general principles as may be legitimately deduced.

I. A. Lapham.

Milwaukee, Wis.

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LIST OF WOOD ENGRAVINGS.

INTRODUCTION.

In the arrangement of my subject, I prefer to make use of the natural features of the State, rather than the political divisions into counties. At almost every annual session of the legislature, the boundaries of old counties are changed, and new ones are established from time to time with the progress of settlement and improvement; while the natural features, the great valleys or basins and their dividing ridges, always remain the same. It is also found that this is a more natural division of the ancient works; for they lie mostly along the valleys of streams, or on the borders of the small clear crystal lakes with which the State abounds. I have also indicated localities by reference to the numbers of the sections, townships, and ranges, as adopted in the government surveys of the public lands, rather than to the names of the towns.

It has been a leading object to ascertain whether any order or system can be detected in the arrangement of the several works. With this view, the exact relative situation of groups of mounds has been carefully observed and delineated; and for the purpose of determining whether there existed any general system of arrangement extending over large districts, the accompanying map (Plate I.) has been constructed, showing the relative position of all the works of which the precise location has been ascertained. This map has been carefully reduced from the public surveys, and exhibits the general features of the State with sufficient minuteness for the purpose intended.

The first narrative in which any notice of the existence of ancient works in this State was made public, is that of Major Long's Expedition in 1823; from which the description of those at and near Prairie du Chien is copied in the following pages. The next is that of the late R. C. Taylor, in Silliman's Journal for 1838, Vol. XXXIV. Dr. John Locke made accurate measurements of several works between the Four Lakes and the Blue Mounds, published in his report on the geology of the Lead Mine District. But the most extended essay is that of Mr. S. Taylor, relating chiefly to the ancient works at and near Muscoda, on the Wisconsin River. The results of these several papers are embodied by Messrs. Squier and Davis in their "Ancient Monuments of the Mississippi Valley," constituting the first volume of the "Smithsonian Contributions to Knowledge."

As the district embraced in these researches has but recently been brought into notice, a short account of its general physical features will not be out of place here, and will aid in understanding the descriptions which follow.

The State of Wisconsin lies between the parallels of 42° 30′ and 47° north latitude, and between 87° and 93° of longitude west from Greenwich; or it extends from the State of Illinois on the south to Lake Superior on the north, and from Lake Michigan on the east to the Mississippi and St. Croix rivers on the west. Its area is about 55,000 square miles. About three-fifths of the State lie in the basin of the Mississippi; and the remainder is drained by the streams tributary to the waters of the Great Lakes—Superior and Michigan. The former portion is naturally divided into five great valleys, occupied by as many principal streams—the St. Croix, Chippewa, Black, Wisconsin, and Rock rivers. The latter may be divided into three parts—that drained directly into Lake Michigan, the basin of Green Bay and its tributaries, and that which is drained into Lake Superior.

These several hydrographical basins indicate also the general topography of the State. The dividing grounds between the basins attain usually but a slight elevation above the surrounding country; so that it frequently happens that a lake or marsh is drained in two opposite directions, and the water sent towards the ocean at widely different points. These water-sheds, or "divides," as they are called, attain their greatest elevation about the sources of the Montreal River; where there is found a continuation into Wisconsin of the Porcupine Mountains of the Lake Superior Mining District. At one point near this place, the ridge is about 1,150 feet above Lake Michigan;[1] while at the western boundary of the State it is diminished to about 500 feet. The region around the source of the Wisconsin River is a grand summit, from which the rivers flow in every direction like the radii of a circle. They run into the Mississippi River, Lake Superior, and Green Bay.

The surface of Wisconsin may be characterized as nearly level, or gently rolling, except along the banks of the Mississippi, and the lower portions of some of its principal tributaries, where it is more broken, and where steep rocky cliffs and precipitous hills abound. There are also prominent peaks in this region, which tower above the general surface, so as to form conspicuous objects in the landscape; of these the Blue Mounds are the most elevated, being 1,224 feet above Lake Michigan.

There is a ridge of broken land running from near the peninsula between Lake Michigan and Green Bay, in a southwesterly direction, through the western parts of Manitowoc, Sheboygan, Washington, and Waukesha counties, and thence into Walworth and Rock counties. It is from three to five hundred feet in height, with an occasional peak of even eight hundred feet above Lake Michigan, and consists of irregular elevations and depressions throughout its whole course. At places the depressions are more regular, and from their round form are called "pot-ash kettles." They are doubtless owing to the decay and gradual washing away of the soft and easily decomposed limestone by which the ridge is probably underlaid.

Another prominent feature in the topography of Eastern Wisconsin, is the cliff or escarpment of limestone resembling the "mountain ridge" of Western New

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[1] U. S. Geological Reports.

York, extending along the eastern shore of Green Bay, and thence, in the same general direction, through Brown, Calumet, Fond-du-Lac, and the eastern part of Dodge counties. It constitutes the cliffs along the east side of Lake Winnebago; and interrupts the flow of the rivers west of it in their course towards Lake Michigan, turning them northward into Green Bay. From its crest another system of rivers originates, which, running in the same general direction, flow into Lake Michigan. Immediately west of this bold escarpment commences a remarkable series of ridges, probably caused by "drift" agencies (whatever they may have been), and of which some notice will be found in the following pages.[1]

The moderate elevations, and the gentle declivities of the several valleys, cause the waters to flow in slow and uniform currents, and to assume, in very numerous instances, the form of lakes of greater or less extent. It is precisely such localities that afford the greatest facilities for Indian population. During the hunting season, the wild man roams over the vast forests and prairies; but his village is always established near some lake or gently flowing river, abounding in fish and wild rice, and affording him a subsistence, either directly or indirectly, by enticing within his reach innumerable animals that seek their food at the same place.

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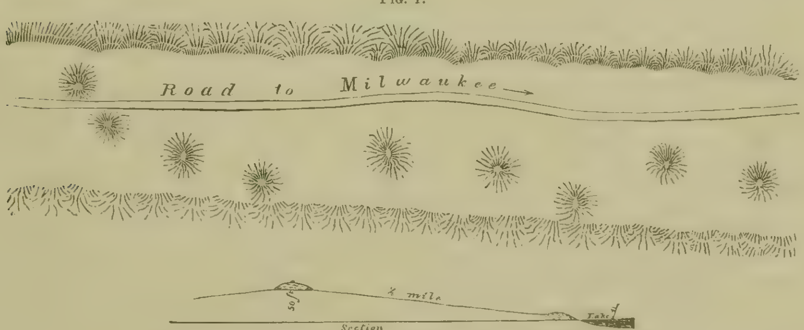
[1] See Plate XXXVIII.

CHAPTER I.

ANCIENT WORKS IN THE VICINITY OF LAKE MICHIGAN.

The most southerly point on the west shore of Lake Michigan where traces of ancient labor can be found, is about four miles south of the "State line" between Wisconsin and Illinois. These works are doubtless burial-places, and consist of a series of round or conical mounds, nine in number, from three to five feet in height, and about thirty feet in diameter, arranged in a serpentine row along the crest of a ridge of sand, an ancient lake beach, which extends for many miles along the lake shore. (See Fig. 1.) We first saw this beach in the road three miles north of Racine, and traced it at intervals into the State of Illinois. It has an elevation estimated at fifty feet above the present level of the lake, and at the mounds affords a good view of the country on both sides. It is here about half a mile

Fig. 1.



Mounds on the ancient Lake Beach, four miles south of the State line.

distant from the lake. It consists of sand and gravel, and rests upon a bed of hard clay. There is no doubt that this ridge extends south to the end of the lake, and is connected with the remarkable series of ridges described by Prof. Shepard.[1] It is occupied by the main road from Milwaukee to Chicago, and is frequently so broad on the top as to afford room for buildings.

We saw no other mounds, nor could we hear of any in this vicinity. Some surveys, however, made by Professor Lathrop, indicate that the "turtle" form extends down Rock River as far as Rockford, or within six miles of the Kishwaukee. Traces

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[1] Amer. Journ. of Science and Arts, XXXIV. 134.

were discovered between this place and the State line. We were told that the row of mounds found here was straight; but examination shows it to be otherwise. Their serpentine arrangement is not, however, deemed a matter of much importance; for where no efforts were made to secure regularity, some such disposition of the mounds would be quite natural. A few miles south of this place is the town of Waukegan, which was formerly called Little Fort, in commemoration of the fact that something once existed there supposed to be the remains of a small fort; but whether or not it was the work of the aborigines, is not known.

At the city of Kenosha we found, on the ancient sandy beach upon which the city is partly built, abundant evidence of a former manufactory of arrow-heads and other articles of flint. Several entire specimens were collected after a little search, besides numerous fragments that appear to have been spoiled in the process of chipping them into form. It is not easy to conceive how such work could be done at all with the scanty tools of the natives; and we are not surprised to find that there were many failures. The chips, or small fragments of flint, were very abundant in numerous places along the sandy ridge, especially near the "Durkee House," and in the vicinity of the burial-ground immediately south of the city. Many different kinds of flint, or more properly of chert, appear to have been wrought at this place, as is shown by the fragments. It is quite probable that the pebbles or boulders along the lake shore furnished the material employed by these early manufacturers; for flint of the same kind may be seen there in abundance. These pebbles are from the corniferous rock of Eaton, and here constitute a portion of the drift, being associated with the tough blue clay that underlies the sand, and is the basis of the whole country around. The clay is carried away by the dashing waves, leaving a beach of clean pebbles, kept constantly smooth and round by attrition. Numerous fragments of pottery, of the usual form and composition, were also found on the same sandy places.

No ancient works were noticed along the valley of the Des Plaines[1] River, which here lies between Lake Michigan and the Pishtaka River.

Proceeding northward from Kenosha, along the west shore of Lake Michigan, the next evidences of ancient labor are found at Racine; showing that, notwithstanding the great difference between the moral, social, political, and other conditions of the red and white man, they usually fix upon the same points as favorite places of residence. The map (Plate II.) will convey to the reader a correct idea of the interesting groups of works at this place. In the examination of them, and in the preparation of this map, I have been materially assisted by Dr. P. R. Hoy, of Racine. The works occupy the high ground bordering upon Root River, from one to two miles from the margin of the lake, and immediately back of the city limits. They consist mostly of circular burial-mounds, of no great size or height, with one circular inclosure, and several tapering ridges. There are also two semicircles opening on the edge of the bluff towards the river. The group of very numerous and remarkable mounds represented at the lower part of Plate II.

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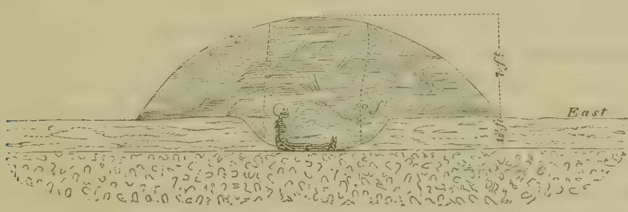
[1] Usually called "Aux Plaines."

was surveyed with some minuteness, with a view to detecting the order of arrangement upon which they were constructed. The result shows very clearly that no order or system was adopted. Each person buried was placed where chance might lead the relatives or friends to select the spot. No three mounds could be found on the same straight line; indeed, it seems as if it were the intention of the builders to avoid all appearance of regularity. Large mounds are interspersed with smaller ones, without regard to symmetry or succession.

Dr. Hoy has recently opened one of these mounds, and found in it the skeletons of seven persons, buried in a sitting posture, and facing the east. (See Fig. 2.) The bones were not accompanied by ornaments or articles of any kind that had resisted the destructive effects of time. The teeth of the adult skeletons were much worn,

Fig. 2.



Ancient Mound at Racine, examined by Dr. P. R. Hoy.

but sound and firm. It was observed that the muscles of the jaws must have been unusually large and strong. The bones of the skull, except in one instance (probably that of a female), were found to be remarkably thick and solid. These skeletons were much decayed, and could not be restored. The mound opened was seven feet high and fifty feet in diameter, being the largest of the group. A basin-shaped excavation had been made in the original soil, about eighteen inches deep, reaching to the gravelly subsoil, upon which the skeletons were placed side by side, all facing in the same direction. The legs, which had been laid horizontally, retained their original position; but the skulls and bones of the bodies were huddled together by the settling upon them of the earth in which they were placed. There were no indications of fire.

Another mound of smaller dimensions, opened under my inspection, contained a confused mass of bones, also very much decayed, and resting upon the gravel, which was here two feet below the original surface. Bones of at least three individuals were discovered. Their confused condition might be owing to the custom, still prevalent among the Indians, of placing the bodies of those who die or are killed away from home, in trees, where they remain until the softer parts are decayed and gone, when the bones are collected and buried. No ornaments, or indeed remains of articles of any kind, could be found in this mound; nor was here any charcoal, burnt clay, or other indication of fire.

These mounds were made from the surface soil; and no traces of excavations, or places whence the materials were taken, could be detected. It is not probable that the earth was penetrated more than a few inches to obtain the quantity necessary

to form the mounds, some of which are quite small, not more than one or two feet in height above the original surface of the ground. They are of various dimensions, from five to fifty feet in diameter, and from one to seven feet in height. Many of them are now nearly levelled by the plough. They may still, however, be detected in the cultivated fields by a trifling elevation, or by a slight difference in the color of the soil. In one case, at least, the plough had turned up the bones from beneath.

The plank road leading from the city to Rochester and Burlington, on the Pishtaka River,[1] passes near this great group of ancient mounds. Many of them are on the line of another road, and are levelled from time to time by the inhabitants in working out their road tax, without regard to the sacred deposits they contain; and in a few years, all traces of them will be gone for ever. This spot was probably the common cemetery for the neighboring tribes, and not their place of residence. Its situation, on the level ground back from the river and bluff, and at the head of a deep and narrow ravine, may be adduced as an evidence of this. The fact that seven bodies were buried in one mound apparently at the same time, and three or more in another, seems to indicate that many died simultaneously by some calamity.

Subsequently to my visit to this locality, Dr. Hoy informs me that he "had the good fortune to obtain two vases of pottery from one of the mounds. They were in a gravel-pit, two feet and a half below the original surface of the ground, in immediate contact with the fragments of two skeletons much decayed. One is made of cream-colored clay and white sand, quite similar in composition to our pale bricks. It has a nearly uniform thickness of about one-fifth of an inch, and was originally quite smooth and hard. I have so far restored it as to render it a good specimen. It would hold about five quarts, being seven inches in diameter at the mouth, and eleven and a half inches high. The other is of a red, brick color, about half as large, much thicker and coarser, and crumbled a good deal in handling. A considerable portion of gravel was used in connection with the clay in its fabrication."

Dr. Hoy further adds: "Some workmen, in digging a ditch through a peat swamp, near Racine, found a deposit of disks of hornstone, about thirty in number. They were immediately on the clay at the bottom of the peat, about two feet and a half below the surface. Some of the disks were quite regular; they vary from half a pound to a pound in weight."

The following account of the ancient works near Racine, furnished by Dr. Hoy, will be found to contain additional details, with some inferences in regard to their age, and the character of the people who made them.

"The most numerous and extensive group is situated one mile west of the city. It embraces sepulchral mounds, all small, from one to eight feet high, unaccompanied by circles, effigies, or other earth-works. The city cemetery, just located, embraces a part of these mounds, which will be preserved, adding not only beauty but interest to the rural spot.

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[1] Or Fox River of the Illinois.

"On the point of the high bluff marked A on the map (Plate II.) is a mound six feet high, in connection with an embankment 235 feet long. This embankment is two feet high, and twelve feet wide at the point nearest to the mound, and tapers gradually to a mere point at its western extremity, near a spring. I am informed that there were formerly other works connected with this, which have been obliterated by cultivation and other improvements. (An enlarged plan of this interesting group is shown on Plate II.)

"A little further east, on the same side of the river, is a single low mound, occupying the projecting point of a bluff. Opposite this, on the north bank of the stream, there is a cluster of mounds crowded into a small space, bounded on the east by a long mound, and on the west by a 'lizard mound'[1] eighty feet long.

"The remaining works, situated on the bluff north of those last named, consist of three lizards, one oblong and six conical tumuli, and three inclosures. The two semicircular embankments are situated on an almost inaccessible bluff eighty feet high. The embankments are slight, not over one foot in elevation, and ten or twelve feet broad, but perfectly distinct and well defined. There is some evidence that they formerly constituted graded ways leading to the river. They are tolerably well situated for works of defence, but, without the addition of palisades, could afford no protection. The small circle, from its size and position, could scarcely have been designed for a work of defence. Neither of these has any perceptible ditch on either side; if one formerly existed, it is now obliterated. The 'lizards' are much alike, from two to two and a half feet high, and from twelve to fourteen feet broad at the shoulders, the tail gradually tapering to a point. The longest is 130 feet, and the shortest 80 feet in length.

"In addition to the works represented on Plate II., there is a cluster of eight mounds, situated on a sandy ridge, three-fourths of a mile further south.

"I opened one of the lizards, but found nothing. We excavated fourteen of the mounds, some with the greatest possible care; they are all sepulchral, of a uniform construction, as represented by Fig. 2. Most of them contained more than one skeleton; in one instance, we found no less than seven. We could detect no appearance of stratification, each mound having been built at one time, and not by successive additions. During these investigations, we obtained sufficient evidence to warrant me in forming the following conclusions. The bodies were regularly buried in a sitting or partly kneeling posture, facing the east, with the legs flexed under them. They were covered with a bark or log roofing, over which the mound was built. The apparent confusion in which the skeletons are sometimes found, is owing to their falling over at different angles, at the time, perhaps, of the giving way and caving in of the temporary roofing. It is quite common to find skeletons before reaching the primitive receptacle or pit. These were undoubtedly subsequent interments, made by the modern Indians. They are in a

[1] This appellation is given for convenience to a class of mounds having two projections or legs on one side near the larger extremity, without pretending that they were actually intended to represent lizards.

different state of preservation, and are mostly found in an extended posture. All the primitive crania were crushed and flattened by the weight of the superincumbent materials. In two instances, however, I succeeded, by great care and labor, in restoring these flattened fragments to their original shape. One of them is represented on Plate LIII. It was found in one of the mounds of the crowded group on the north side of the river. The two are much alike, and quite different in several particulars from the various Indian crania that I have examined. The zygomatic arch has not the same projection, the angle of the cheek-bone is more obtuse, and the orbits are rather less angular than in the modern Indian. The heavy, projecting jaw, and the flattened occiput, are quite characteristic of these ancient mound skulls. Facial angle, 76°. Internal capacity, eighty cubic inches.

"No implements or ornaments were observed in the mounds, excepting in three instances, in which rude pottery was found. The shape of the pots is precisely similar to those said to be used by the Burmese for all culinary operations. They place three stones in a triangle to support the pot in a perpendicular position.

"The disks of hornstone were obtained while digging a ditch through a peat swamp one-fourth of a mile south of the mounds represented on the plate. (Plate II.) About forty were taken out. They were situated immediately on the clay stratum, underneath the peat, which was two feet thick at this point. A number of arrow-heads and stone axes have been found in the vicinity.

"In regard to the antiquity of the works at Racine, it may be stated that, on the mound from which I obtained the pottery, there was a burr-oak stump (*Quercus macrocarpa*), which contained two hundred and fifty rings; and the tree was cut ten years since, when the land was first occupied. Near this I excavated another mound, on the centre of which were the remains of a large stump which must have been much older. Immediately under the centre of this stump I obtained the cranium before mentioned. A stump on the long mound at A (Plate II.) has 310 rings; and near by are the remains of a large tree, and an oak stump five feet in diameter. These facts indicate an antiquity of at least a thousand years.

"In conclusion, I must remark that whatever be the legitimate inference drawn from similar works and remains in other places, concerning the state of civilization attained by the mound-builders, the evidence here goes to prove that they were an extremely barbarous people, in no respect superior to most of the savage tribes of the modern Indians."

Much care has been taken to present an exact figure of the skull discovered by Dr. Hoy, which he proposes to contribute to the museum of the Smithsonian Institution.

Between Racine and Milwaukee we found a single mound, which was six feet high, and the remains of one or two more about half a mile below the place where the main road crosses Oak Creek. This mound was more than usually steep on its sides, and may consequently be supposed to be of recent origin, time not having levelled it down as much as those of greater antiquity. A mound that had been

removed several years since, disclosed a number of skeletons of human beings, and an earthen cup said to hold about a pint.[1]

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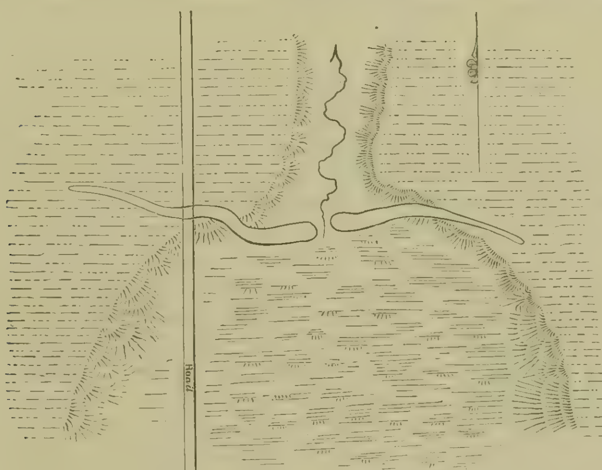
[1] During the investigations of which the results are here given, I was often led to examine places supposed to be the work of the aborigines, but which proved to be attributable to other than artificial causes. On the northwest quarter of section fifteen, in the town of Lake, three miles south of Milwaukee, are three elevations, supposed by some to be artificial. They are composed of gravel and small boulders, and fragments of limestone; materials seldom used by the mound-builders. They are larger than any artificial mounds heretofore discovered in this State, though not larger than some in Ohio and other portions of the West. There are numerous other swells similar to these in the vicinity, though not so regularly conical. These undulations of the surface were produced by the same causes that transported to this region from the north the vast superficial deposits known to geologists under the name of drift. One mile north of this place we stopped to examine an embankment extending across the road, which was at first supposed to be artificial, and to represent the "serpent." (See Fig. 3.)

FIG. 3.



Beaver dam, four miles south from Milwaukee.

It was traced for about 150 feet west of the road, where it gradually disappeared as the sloping ground became more elevated. Towards the east it gradually enlarged. It was irregularly curved, or serpentine, in its shape. At a short distance to the east it had been worn through by a small stream, but continued again, until it gradually disappeared as before, on the gently rising ground beyond the creek. It had evidently once been continuous across the stream, where it was largest and highest. Above the embankment was a marsh covered with flags (*Iris versicolor*) and sedges (a species of *Carex*), where evidently a pond had once existed. This embankment was the work of the beaver, being the remains of a "beaver dam." These industrious animals have left as indelible traces of their former existence here as have the mound-builders. Their works are scattered very extensively over the State, causing, as in this instance, many of the "cat-holes," or marshy places in the woods. The remains of their "washes," left on the sloping banks above the dams, have been mistaken for Indian excavations in search of lead or other ores, &c.

But the most remarkable natural appearances we were led to examine were the ridges in a large natural meadow in the town of Brookfield, Waukesha County, which were supposed to be artificial

The relative position and extent of the earthworks in the vicinity of Milwaukee, will appear on reference to the map, Plate III. They extend from Kinnickinnic Creek, near the place known as the Indian Fields, to a point six miles above the city. It will be observed that they occupy the high grounds along the margin of the river and streams, but not on the immediate shore of the lake. Although the mound-builders often occupied the margin of the smaller lakes in the interior, they seldom or never selected the immediate shore of Lake Michigan for the site of their works.

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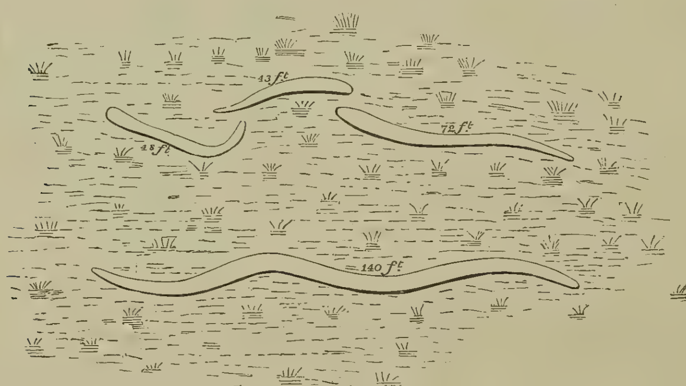
representations of the Massasauga rattle-snake. My attention was first called to them by Mr. M. Spears, who detected them. They vary from a few inches to two feet in height, above the otherwise uniformly level surface of the marshy ground; and in length they vary from ten or fifteen to one hundred and forty feet. Many of them are obtuse at one end, and tapering and acute at the other, as if intended to represent the head and tail of a snake; others are acute at both extremities. (See Fig. 4.) The accompanying figures show their appearance and relative situation. Some are so

Fig. 4.



Serpent-form ridges, Brookfield.

arranged that, were they larger and differently situated, we might suppose them portions of a fort, with a guarded entrance. They are composed of the same black mucky earth that constitutes the surface soil of the marsh. They have all the same general direction, being parallel, or nearly so, with that of the marsh. There are great numbers of these ridges, not less, perhaps, than one hundred on this marsh.

To understand how these ridges were probably formed, we must take into account the soft nature of the surface soil; and the fact that, except in the driest portion of the year, it is completely saturated or covered with water. The ice formed on the surface in winter must therefore include a considerable portion of the soil. During very cold weather, this covering of ice contracts, leaving in the middle of the marsh numerous irregular cracks, probably assuming the arrangement and directions of these ridges. As the temperature moderates, the ice expands, closing up the cracks, but moving towards them a portion of the soil, and leaving a slight elevation. The next winter, the same thing is repeated; but the ice being thinner on these slight ridges, it would naturally separate where they occur: and thus the same ridges are enlarged from year to year, until they assume the size and shape now so much resembling serpents. We afterwards saw similar ridges in several other marshes.

The banks of rivers appear to have been their favorite localities; and in this respect they resemble the present Indians, who select sites commanding a view of the country around them (so as to be able to detect the first approach of an enemy), and near hunting and fishing grounds. They appear also to have had an eye for the beautiful as well as the useful, in choosing their places of abode.

From the same hills on which are found these mounds, the workmen, in grading streets, digging foundations for buildings, preparing terraces for gardens, &c., often disinter the skeleton of an Indian, with its accompanying ornaments, and perhaps his brass kettle placed at the head. A number of the skulls thus brought to light were sent to Dr. S. G. Morton, to be used in the preparation of his Crania Americana.[1]

The bluffs along the Milwaukee River, on which these works are mostly situated, have an elevation of from 30 to 100 feet above the water. They are usually quite steep, though not so much so, except in one or two places, as to be precipitous.

There is evidence, drawn from the presence of deposits of fresh-water shells in layers of sand and gravel, that the waters of the lake at this place once stood at a level considerably above their present height; and at that time much of the site of the present city was submerged. The bluffs were then washed by the waters of the bay, and presented steep broken fronts. The banks were gradually undermined, and slides of considerable extent occurred precisely as is now seen on the present margin of the lake. Whether this subsidence was subsequent to the erection of the mounds, is uncertain, their situation being such as to throw no definite light upon the subject. There are no works below that level that can lay claim to great antiquity.

The ancient works about Milwaukee are most numerous at a place near the small creek called the Kinnickinnic, and on lands known as the Indian Fields. They are chiefly in section twelve, township six, and range twenty-one, town of Greenfield. When the country was first settled (in 1836), the place was destitute of trees, and exhibited signs of recent Indian occupancy and cultivation. The creek borders it on the south and west, and an extensive swamp on the north and east, thus separating it from the adjacent country, and rendering it secure from sudden surprise or attack, without the necessity of extensive works of defence. It will be observed, as we proceed, that similar circumstances were often taken advantage of by these careful people.

The fields lie at a considerable elevation above the bottom-lands of the creek, and are much broken and uneven in surface. The soil is loose, sandy, or gravelly, and could be easily worked by the rude instruments of the aborigines; which may have been an inducement for selecting this spot. The subsoil is gravel, to an unknown depth. The Milwaukee and Janesville plank road passes through the fields; and the wood land adjoining has been adopted on account of its gravelly soil, undulating surface, and beautiful forest-trees, as the site of a cemetery for the city, named appropriately the "Forest Home."

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[1] See that work, p. 179.

About fifty circular mounds, and four or five of the lizard form, have been found here. Some of these can yet be traced, though the plough has made sad havoc with most of them. Two of the latter class were here associated in a manner not observed elsewhere in the State. (See Fig. 5.) One is two hundred and fifty feet in length. It is not asserted that these figures were meant by the builders to represent an animal of the lizard form, or an animal at all. Still their great numbers in the eastern part of the State, and their uniformity of general outline, show that this peculiarity of form was not without design. It has been suggested that they may have been intended to represent a war-club with points set in, as is common among some savage tribes; but the attenuated form of the extremity would seem to oppose this idea.

Fig. 5.

As is the case with the works of other forms, there are no two precisely alike in their dimensions, or in their direction with reference to the cardinal points. But it has been observed that the larger extremity, or head, is usually directed *towards the south.* They vary in length from one hundred to four hundred feet. The usual height of the body may be stated at four feet; from which there is commonly a gradual diminution both in height and width to the extremity. It is frequently impossible to decide exactly where it terminates. They are almost always associated with mounds of round or oblong form, usually having about the same general direction. When they occupy the edge of elevated ground, the head generally points obliquely towards the low ground; and the projections or "legs" are on the side towards the ridge. (See Plate V.)

On the land of Mr. Geo. O. Tiffany, half a mile south of Forest Home Cemetery, is a sort of inclosure opposite some very large springs. (See Plate IV. No 1.) The walls are about eighteen inches high, and three or four feet wide. It is on a level flat, from which there is a descent of about eight feet to the springs. The wall is double, as shown by the figure, the outer one interrupted by two gateways. There are some irregular excavations within the inclosure. Large trees grow upon and near the works, constituting a dense forest of thrifty growth. The flat on which these works are built terminates in the rear by high hills surmounted by the mounds before described.

There can be no doubt that this wall of earth is the only remaining trace of some building erected here on account of the copious springs opposite the main opening; but the nature of the edifice can only be conjectured. Perhaps it may have consisted of palisades or timbers set in the ground, against which a bank of earth was erected to secure greater strength and permanency. There is no regular ditch accompanying the wall, as is found in similar works in New York and elsewhere. Immediately above these works another was traced, with a ditch very irregular in its form, direction, and dimensions, which proved to have been the work of the

beaver. This industrious little animal had here set up a colony, and erected his works; his "nation" has had its rise, and its decline and fall, since the aboriginal structures were abandoned.

Further up the creek, on the west side, north of the plank road, and not far from some very large mounds, are three similar works, except that they are not on the immediate bank of the creek. Two of them are represented in Fig. 6.

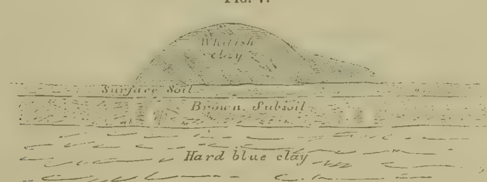
Fig. 6.

The inclosure is about one hundred feet long, and thirty wide, in its greatest dimensions. The opening at d appears to have been caused by the washing away of the earth by the rain that fell within the inclosure. The walls were nine feet wide and one foot high. The small size of these inclosures prevents their ranking with the "works of defence" or other extensive embankments described in the first and second volumes of the Smithsonian Contributions; and we can only suppose them to be the remains of ancient buildings, or structures of some kind, needful in the simple condition of those who erected them.

A few rods east of the cemetery, on the land of Mrs. Hull, may be seen a remarkable excavation, surrounded in part by the earth thrown from it. (See Plate IX. Fig. 1.) It has four sloping ways or entrances, one of them very much elongated; and the reader will not fail to discover in its general figure that of a lizard mound reversed. There are other similar excavations to be described hereafter; from some of which, if we could take a cast and reverse it, we should have an exact representation of a lizard mound.

At Walker's Point were several circular mounds and lizard mounds, now dug away in the process of grading streets. One of them, exhibited in section, was

Fig. 7.



Lizard mound, Walker's Point.

examined during the excavation, and found to be composed of whitish clay, of uniform texture and appearance. The blue, yellow, and red clays, found abund-

antly in the country, all assume a whitish color upon exposure at the surface; and it is, therefore, not difficult to account for the difference in the color of the clay composing this mound, without resorting to the improbable conjecture that it was brought from a great distance. The several layers of soil, brown subsoil, and blue clay, run uninterruptedly under the mound, showing that it was built upon the natural surface. (See Fig. 7.) No excavation had been made, and no relics of any kind were found in it. Indeed, the animal-shaped mounds have never been found productive in ancient relics or works of art. It was probably for purposes other than the burial of the dead, that these structures were made.

Only one locality has been discovered on the east side of the Milwaukee River where the mound-builders erected their mysterious works. This was at the intersection of Johnson and Main streets, where there were formerly two lizard mounds, and some others, as represented on Plate V. On one of these is given the dimensions in feet, showing the method usually adopted in surveying these earthworks. One of the mounds has a slight angle near the extremity of the tail, as represented in the plate; but this is not very common. The other figure is of the more common form. These figures are in their normal position, being on high ground near the edge of a hill or bank, their heads towards the south, legs towards the bank, and their general direction obliquely towards the edge of the bank. A simple oval mound, and one with arms or wings, are seen near the lizards; and a few rods to the north was an oval ring, whose diameters were forty-four and thirty-one feet. The wall was nine feet wide, and only one foot in height.

On the west side of the river, within the limits of the city, were numerous mounds occupying the several promontories overlooking the city and bay. The most remarkable group was near the intersection of Walnut with Sixth Street, as represented on Plate VI. Four different varieties of structures may be seen. The oblong (*a*), which is simply a ridge of earth; the lizard (*b*), an elongated ridge terminating in a point at one end, and having two projections or legs at the other; the winged mound (*c*), being a circular tumulus, with two long, slightly curved arms or wings; and the anomalous mound (*d*), differing from the ordinary form by having the legs on opposite sides, instead of the same side. These works were, in 1836, covered with a dense forest. The oblong, at *a* in the plan, appears to have been the "observatory," being in a very conspicuous place, from which may be seen all the works, while in the opposite direction there is presented a magnificent view of the valley of the river, and the bay of Lake Michigan, now called Milwaukee Bay. It is eighty-three feet long, twenty wide, and four in height.

Two of these mounds were opened, but produced nothing beyond the fragment of a bone, and a slight admixture of carbonaceous matter near the original surface. They were composed of the same tough, reddish, sandy clay that constitutes the adjacent soil. There are two large natural elevations or mounds near these works, and upon the summit of one was a small "winged mound." The other, though the largest, was apparently not occupied by the aborigines. In that part of the city known as Sherman's Addition, we first find mounds of undoubted animal forms. One of these (Plate IV. Fig. 2) is on ground covered by the corn hills of the present race of Indians, who occupied the lands in this vicinity down to a very late

period. It may be considered as a rude representation of a wolf or fox guarding the sacred deposits in the large though low mound immediately before it. Both of these are of so little elevation as to be scarcely observed by the passer by; but when once attention is arrested, there is no difficulty in tracing their outlines. The body of the animal is forty-four feet, and the tail sixty-three in length. A more graceful animal form was found on block No. 36. (See Plate VII. Fig. 2.) It may be regarded as the representation of an otter. Length of head and neck, twenty-six feet; body, fifty feet; tail, seventy feet. Its direction is a little south of west.

Whatever may be said in regard to the mounds which I have denominated "lizards," there can be no doubt that they do, and were intended to represent the forms of animals. But what shall we say of the next figure (Plate VII. Fig. 3), with its long, slightly curved arms? If, like some others hereafter described, it had a beak, it would be considered a representation of one of the feathered tribe; or, if it had legs as well as a body, it might be deemed a rude imitation of the human form. We may suppose that in the lapse of ages these works have been more or less modified by natural causes, and also that portions were constructed of different and more perishable materials, now entirely gone. This figure points almost directly south. It is thirty-four feet long, the arms being sixty feet. It was surveyed by me a number of years since, and was almost immediately afterwards removed to prepare the foundation of a house. How many more of these interesting structures have been lost to the antiquary, by being destroyed before a plan and record of them were made, it is impossible to determine; but their number must be very great.

Proceeding up the river, we find the next works on the school section, between the plank road from Milwaukee to Humboldt and the river. (See Plate VII. No. 4.) They consist of three lizard mounds, and four of the oblong form, occupying a high level plateau completely covered with the original forest trees.

We next find, on sections twenty-nine and thirty, in township eight, and range twenty-two, on the west side of the river, at a place usually known as the Indian Prairie, about five miles north of the city of Milwaukee, a very interesting system or group of works. They are situated on a beautiful level plain, elevated about thirty feet above the river, which runs along the eastern border. The bank of the river is nearly perpendicular, forming a safe protection against attack from that direction. It may be seen by the map presented (Plate VIII.), that these works are further protected on the north and south by deep ravines. The works are all included within these natural defences. Whether they were ever protected on the west seems doubtful. No traces of embankment or ditch could be found, nor any indication of other modes of defence usually adopted by uncivilized nations. There may have been defences of wood, long since decayed.

There are two principal mounds situated near the middle of this space. They are both fifty-three feet in diameter at the base, where they almost touch each other, and eight feet high. The southern one has a level area of twenty-five feet diameter at the top.

It often occurs in a group of works like this, that one mound is erected on the highest position, from the top of which the whole may be seen. These may be called the "Observatories," a name that in this case belongs to the mound with the level area. It may also have been the place of sacrifice or altar-mound; but of this we can only judge from the analogy in form and position to similar works which elsewhere were undoubtedly used for that purpose. Surrounding these are numerous tumuli of a circular form, the exact relative positions of which were ascertained by survey, and represented on the map. No definite system or order of arrangement was observed, as will be evident on inspection.

These tumuli are from two to four feet high, and from ten to fifty-four feet in diameter at the base; many of them being unusually broad in proportion to their height. None are so high and prominent as the two first mentioned. The two mounds in the form of a cross at the southern extremity of this group will at once attract the attention of the reader. An enlarged plan is given of one, with its dimensions. The head of the cross is level on the top and rectangular. This form of mound is frequently found in Wisconsin.

But what marks this locality as one of peculiar interest, is the discovery of five works of excavation, of regular form, being the reverse of the usual works. Instead of an embankment of earth thrown up, we have here a cavity in the ground. Four of the excavations lie in a southwest direction from the two larger central mounds. In approaching the former from the latter, a small trail or path is discovered, which gradually becomes larger and deeper, until it leads into a sunken area surrounded by embankments, composed probably of the earth thrown out of the excavation. Upon looking back, it is perceived that this pathway goes directly to the mounds. These excavations are shown on an enlarged scale on Plate IX. Figures 2 and 3. There are usually three curved entrances to each excavation, as shown in the figures.

The other excavation is similar to these, except that it lacks the long guarded way or approach, leading towards a mound; though the principal openings are towards the "Observatories." (Plate IX. Fig. 4.) It is quite probable that the bottom of these pits was once level, and that the sides were perpendicular, or nearly so; but now they have a gentle slope, and the bottom is concave, as shown by the sections. (Plate IX. Figs. 2 and 4.) With our present limited knowledge of the habits of the people who constructed these works, it would perhaps be idle to attempt to conjecture for what purposes the excavations were made. What structures of wood may have been connected with them is of course unknown. All traces of so perishable a material would long since have entirely disappeared.

The earth thrown from one of these excavations encroaches slightly upon the path leading to another, thus indicating (unless this circumstance has been caused by rains), that they were made at different times. Indeed, it is hardly to be supposed that any extensive system of works was ever planned out by the aborigines, and built up at one time. Those we find were doubtless the results of successive efforts, perhaps by separate and distinct generations, and even in some instances by distinct tribes.

We observed four small circular inclosures, about thirty feet in diameter, the

ridge having no great breadth or elevation. One circle surrounded a cavity two feet deep, in which was growing a group of basswood-trees (*Tilia americana*) of large size. There are at this locality two crosses, two oblong and twenty-two circular mounds, and five excavations.

Although this spot has long since ceased to be the residence of an Indian population, yet it is annually visited by a few families, and numerous traces of their presence are still visible. Many of the mounds have been opened for the burial of the remains of Indians recently deceased; and we saw on one mound three graves but lately formed. They were secured from the ravages of the wolves and other animals, by logs of wood held in their places by four stakes, in the manner represented on Plate VIII. Only one kind of wood is used on the same grave, there being no mixture of different trees on any. One grave was covered with logs of iron-wood (*Ostrya virginica*), the other two with those of oak; even the stakes are of the same wood as the logs. These logs were from four to six inches in diameter, and four and a half feet long. The grounds in the neighborhood, and for some distance north and south of the ravines forming the boundaries of the more ancient works, are covered with those common mammillary elevations known as "Indian corn-hills." They are without order of arrangement, being scattered over the surface with the utmost irregularity. That these hillocks were formed in the manner indicated by their name, is inferred from the present custom of the Indians. The corn is planted in the same spot each successive year, and the soil is gradually brought up to the size of a little hill by the annual additions. This is the work of the women.

At the southern extremity of these remains, another evidence of former cultivation occurs, consisting of low, broad, parallel ridges, as if corn had been planted in drills. They average four feet in width, twenty-five of them having been counted in the space of a hundred feet; and the depth of the walk between them is about six inches. These appearances, which are here denominated "ancient garden-beds," indicate an earlier and more perfect system of cultivation than that which now prevails; for the present Indians do not appear to possess the ideas of taste and order necessary to enable them to arrange objects in consecutive rows. Traces of this kind of cultivation, though not very abundant, are found in several other parts of the State.

But, however ancient these garden-beds may be, they were not made until long after the erection of the earthworks; for, as will be seen (Plate VIII.), they extend across them in the same manner as they do the adjoining grounds. Hence it is evident that this cultivation was not until after the mounds had lost their sacred character in the eyes of the occupants of the soil; for it can hardly be supposed that works executed with so much care would be thus desecrated by their builders. The original inhabitants must therefore have been succeeded at an early period by probably another race, and the labors of the white man have consequently not alone tended to obliterate these vestiges of an ancient people.

We have thus traced four probable epochs in the history of this interesting locality. 1st. The period of the mound-builders, who, perhaps, selected it on account of its naturally secure position. 2d. That of the "garden-bed" culti-

vators. 3d. That of occupancy by the modern race of Indians. 4th. The present period, when their descendants continue to visit it, and to bring hither the remains of their departed friends.

A few circular mounds, but no other works, are found near Saukville, on the Milwaukee River, in Ozaukee County. At this place was discovered one of the most regular and best finished stone axes that we have obtained. A little further west, on the road to Newburgh, is a group of oblong embankments, occupying the end and flanks of a ridge, as represented on Plate X. Here is a mound established, as is usual, on the highest point; and if the forest were removed, it would command a very extensive view of the surrounding country. Whether the peculiar arrangement of these oblong elevations is the result of design or accident, is not easily determined. There can be little doubt that the place was a station for a look-out, or post of a sentinel, whose duty it might be to give notice of the approach of an enemy, or perhaps to detect the presence of game in the country. The earthworks are not of such magnitude, nor are they so arranged, as to justify the conclusion that they constituted a work of defence; and they may be only receptacles of the last remains of some distinguished persons.

On the south side of the Milwaukee River, in the town of Trenton, are several groups of works not visited by me. One of them, surveyed by my friend, Mr. L. L. Sweet, is represented on Plate X., and, as described by him, consists of a turtle, two crosses, two club-shaped, three oblong, and five conical mounds. They are situated on lots numbered six and seven, of section eighteen, in township eleven, and range twenty. "I carefully noted," says Mr. Sweet, "the dimensions, &c., of the most important of these mounds, and send you the result. The largest cruciform figure is one hundred and eighty-five feet in length of trunk; the head, twenty-four feet long; the arms, seventy-two feet each; the height at the head, three feet ten inches; at the centre, four feet six inches. Uniform width of the head at the base, twenty-eight feet. The shaft gradually diminished in height and width to a point at the end. The appearance is that of a cross sunk in light earth, in which the lower extremity is still buried beneath the surface. I was forcibly struck with the fact that the arms were of exactly equal length, and at right angles to the trunk. I felt and said, Here is order and design; but what that design is, we probably never shall know. Is it possible that the people who constructed these works found their way to this continent after the Christian Era? Perhaps not; yet curiosity will make the inquiry. Two round mounds near the foot of this cross are each three feet high, and twenty and twenty-two feet in diameter at the base. The oblong bears N. 22° E., and is sixty-eight feet long, twenty-two wide, and four feet five inches high; the ends are square."

"The smaller cross is one hundred and sixty feet long; the head, twenty-two feet; the arms, each fifty-one feet; the height two feet eight inches. It terminates in a point, and resembles the large one in every respect. The body of the "turtle" is twenty-two feet long, and fifteen feet wide; the head, four feet long; the height three feet eight inches. It has but three legs, one of which seems to have been left unfinished or destroyed. The head is towards the river. There are some other small mounds in the vicinity, not represented on the plate. The ground on which

these works are situated has a gentle inclination towards the river, the banks of which are about three and a half feet high; the water has but a moderate current. The soil is composed of a dark sand, with a slight admixture of loam."

I am further indebted to Mr. Sweet for a survey and brief notice of the group of works on section thirty-one, township twelve, range twenty, represented on Plate XI. They consist mostly of ridges of earth from three to four feet high, and from twelve to fifteen feet wide at the base, and are of various lengths. They are supposed to have been originally square at the ends, but now are rounded by the effects of rain, &c. One mound, one hundred and thirty-two feet in length, is shaped like a war-club. "It has been asserted," says Mr. Sweet, "that this was a regular fort, being an inclosure; but on a careful examination, I find it is not so. The long mound (thirty-two rods in length) with another at right angles to it, upon a hasty examination, might suggest that idea; but the full survey shows that the conclusion would be a wrong one. The land here and for some distance around is level, the soil sandy, lightly timbered with iron-wood (*Ostrya virginica*) and sugar maple, with no large trees. There are no streams of water within half a mile of these mounds." The last mentioned circumstance is rather unusual.

There are said to be other localities still further up the Milwaukee River; but their exact situation could not be ascertained, nor could I obtain any reliable account of their character and extent.

Proceeding northward, in the vicinity of the west shore of Lake Michigan, we find the next ancient works on the Sheboygan River.

Plate XII. shows the general character of a very interesting group at the country residence of Dr. J. F. Seely, on a prominent point of land on the north side of the river, three miles above its mouth. They are in the northeast quarter of section twenty-eight, in township fifteen, and range twenty-two. The mounds are mostly of the kind called "lizards," though presenting some remarkable variations from the usual type of the species, as a naturalist would say. In one the tail is crooked, with a double curve of serpentine form; in another it makes a considerable angle with the body; and a third has the front leg or projection extended forward. Two of the mounds are apparently of the same general character, except that they have two gradually tapering extensions or tails, projecting in opposite directions, as will be seen by reference to the plate. At the Doctor's house is a work consisting of three nearly parallel ridges, united at the southern extremity, not far from the edge of the steep hill on which the preceding works are situated. They are about two hundred feet in length, but have only a slight breadth and elevation.

This promontory resembles in its general form the fortified hills so often found in Northern Ohio and in New York; but, after a careful search, no trace could be found of a wall extending across from one hill to the other. The occupants probably relied for defence upon the natural security of the position, as in numerous other instances in Wisconsin.

Other works are known to exist towards the head of this fine stream.

With the exception of a few small mounds near the village of Manitowoc, we have now described all the ancient works in the vicinity of the "Great Lake." The last named are situated on the northeast quarter of township nineteen, half a

mile northwest of the village. One of them was penetrated to some depth below the original surface, but not the least trace of any deposit could be detected. Pits had been dug in several other mounds, and, so far as we could learn, uniformly with the same negative results. The soil here is sandy, and the materials of the mounds consist of sand, with spots of darker color or mould, as if portions of the surface soil were mixed with the sand. There are eight mounds, situated on a level plain elevated about sixty feet above the river, to which there is a very steep descent. They are not exactly round, but of an oval form: the longest diameter lying in a north and south direction, or at right angles with the steep bank.

The following notice of the works near Manitowoc[1] is from a letter written by Mr. Charles Musson of that place. "There are some mounds and embankments, or breastworks (or what seem to have been used for that purpose), found about half a mile northwest from the town, on a high, level, and dry piece of ground of considerable extent. These embankments now rise to the height of about four feet; their breadth at the base being from ten to twelve feet. In one place there are two, ranging north and south, parallel to each other; one about thirty rods, the other forty rods long, and seventy rods apart. They present every appearance of having been works of defence for two contending parties. In the vicinity of the breastworks, between and to the south of them, are about twelve mounds, varying in size; some are as large as fifteen feet in diameter at the base, and eight feet in height. Some of these have been opened, and, I think, in one bones were found; but nothing certain can now be known. It seems highly probable that this might have been a battle ground, and these mounds the burial-places of the slain. The suggestion is not the less probable from the fact of there not being anything in them which can be recognized as human remains. For it is certain, from the size of the trees now growing on the apparent fortifications, that they must have been erected centuries ago; some are pine trees four feet in diameter."

These works are supposed to be the northern limit of ancient monuments on or near the lake shore.

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[1] Represented on Plate XXXII. No. 3.

CHAPTER II.

ANCIENT WORKS IN THE BASIN OF THE PISHTAKA RIVER.

This stream is usually called Fox River; but, to distinguish it from the numerous other rivers of the same name, it is necessary to call it the Fox River[1] of the Illinois. It originates in the northeastern part of Waukesha County, and runs in a southerly direction through the western part of Racine and Kenosha counties into Illinois. It thence passes by way of the Illinois River into the Mississippi. Within the State of Wisconsin its basin covers an area of nine hundred and forty-five square miles.

The ancient works in the valley of the Pishtaka extend as far down as to the place where Major Long and his party crossed it, a little north of west from Chicago. "At this point," says the narrator, "the river has a fine gravelly bottom, and was very easily forded. On the west side we reached a beautiful but small prairie, situated on a high bank, which approaches within two hundred and fifty yards of the edge of the water; and upon this prairie we discovered a number of mounds, which appear to have been arranged with a certain degree of regularity. Of these mounds we counted twenty-seven. They vary from one to four feet and a half in height, and from fifteen to twenty-five in length; their breadth is not proportioned to their length, as it seldom exceeds six or eight feet. They are placed at unequal distances, which average about twenty yards, and are chiefly upon the brow of the hill; but some of them stand at a greater distance back. Their form appears to have been originally oval; and the slight depression in the ground observed sometimes on both sides of the mound, seems to indicate that it has been raised by means of the earth collected in its immediate vicinity. Of their artificial nature no doubt could be entertained."[2]

About a dozen localities are known along this stream and its branches, within the limits of Wisconsin, at which mounds have been erected by the ancient occupants of the country. Near the southern boundary of the State are a few works, as on the northwest side of Silver Lake, in the town of Salem (section eight, township one, range twenty), where there are some burial mounds; and a little north of the road (southwest quarter of southeast quarter of section five, township one, range twenty) are two oblong mounds, which, from their position, are supposed to be

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[1] It is said that the Indians called all rivers with numerous short bends by this name, from the resemblance of their course to that of a fox when pursued.

[2] Narrative of an Expedition to the Source of the St. Peter's River, &c., I. 176. Philadelphia, 1824.

"look-out" stations. They are situated near some quite remarkable bluffs of limestone gravel, and command an extensive view of the valley towards the south, with its beautiful lake and ancient remains.

Mound Prairie, in the western part of Wheatland (township one, range nineteen), is a small and beautiful prairie lying between two fine groups of lakes; and is so named from some artificial works near the centre of the prairie. We found six or eight circular mounds, and one that appeared to have been a "turtle." They were nearly destroyed by the plough.

Near the village of Geneva (section thirty-five, township one, range seventeen), there were two turtle mounds, and several of the ordinary circular or conical form. They are situated near the lake with their heads towards the water. A road passes directly over them, and they are now (1850) nearly destroyed. Further search would probably reveal the localities of other works about these lakes.

Five miles south of Burlington (on the northwest quarter of section twenty-six, township two, range nineteen), is a solitary animal mound, with curved tail, and enlarged at the extremity, as shown in the figure. (Plate XIII. No. 1.) It is situated on a gently sloping hill side, and the road passes directly over it. It is a very unusual circumstance to find such a mound disconnected from other works; but we could not learn that any others existed in the vicinity.

On the east bank of the river, opposite the village of Burlington, is a series of mounds arranged in an irregular row along the margin of the stream. (See Plate XIII. No. 2.) The largest of the series, near the middle, is ten feet high, and fifty feet in diameter at the base. It is connected with the next by an embankment, a circumstance observed in several other cases. At the north or upper end of the series, are four oblong mounds; one with a divided extremity, or horns, as shown in the drawing. Eleven conical tumuli may yet be traced; and some others, it is said, have been removed. Persons of lively imagination might suppose this series to represent a serpent, with mouth open, in the act of swallowing its prey; the series forming a sort of serpentine row.

A little west of the village is a small inclosure of oval form, the embankment having but a slight elevation. It may have been the place of a mud-house, or some structure the decay of which has left only this evidence of its former existence. There are said to be others similar to it in the vicinity. A stone axe and a flint arrow-point were obtained here.

On the west side of Wind Lake (northeast quarter of section eight, township four, range twenty), we discovered five conical mounds, but no other works in their vicinity. Also on the west side of Muskego Lake (east half of northeast quarter of section sixteen, township five, range twenty), is a group of works represented in Plate XIV. No. 1. They consist of two parallel ridges at the extremity of a small promontory nearly surrounded by marshy grounds, and a ridge and some circular mounds on another point of land opposite. There is a remarkable excavation in the bank here, which is doubtless the work of art; but its origin and the purpose for which it was made can now only be a subject of conjecture.

These parallel ridges have been represented as the remains of a fort or fortified promontory; but a glance at the plate will show that no such object could have

been the motive of their construction. Instead of extending across the neck of the peninsula, as in the "fortified hills," and thus defending the approach to the position, they occupy a place near the extremity of the high land.

Proceeding up the valley of the river from Burlington, there are no remains for a distance of twelve miles. We then find those represented on Plate XV. By invitation, we took up our quarters at the house of Mr. Isaac Bailey, where it was once proposed to build a village or city, to be called "Crawfordsville." The city was never built, and the name is only remembered by a few of the oldest inhabitants. This is the place mentioned by Mr. R. C. Taylor[1] as stated in the western papers to contain a group of mounds resembling lizards, alligators, and flying dragons.

On Plate XVI., I have endeavored to represent these monsters as they appear upon careful survey and plotting. They occupy ground sloping gently towards the river at the north and northwest, their heads pointing up hill, and their general course southwesterly. The winged mounds or dragons (three in number) appear to lead the flight or march of the other animals, and to be heralded by a host of simple oblong figures, extending nearly half a mile in the same direction. An enlarged view of one of the winged mounds is shown on Plate XVII. No. 1; and the group of oblong mounds, forming the "advance guard," is shown on Plate XIV. No. 2.

The main figure in the general group is shown on an enlarged scale (Plate XVII. No. 2), and is two hundred and eighty-six feet in length. This and the one immediately preceding it are good representatives of the kind called lizards; while the two exterior figures, having four projections or feet, are always called turtles by the most casual observer. One at the right appears to have been intended for a lizard, but is without the tail. These are from two to six feet in height.

A little north of the mounds represented on Plate XVI. is a very large one, ten feet in perpendicular height, and eighty feet in diameter at the base. Its situation is such as to command a view of the valley for two or three miles both above and below. It had been opened prior to our visit, but without important results. It has an appendage consisting of a slight ridge of earth, sixty feet long, extending from its base in a northeasterly direction. Immediately north of it is an excavation from one to two feet in depth. The earth taken from this excavation, however, would make but a small part of the large mound. South of these the ground continues to rise to a high ridge, occupied by the roads, as shown on the map, Plate XV.

As seen by the plate, many of these mounds are in a grove of timber, and have not been disturbed by cultivation. It is very much to be hoped that the good taste of the present intelligent proprietor will induce him to preserve them from destruction. This locality was doubtless one of much importance to the original inhabitants. It is protected on three sides by the marshy grounds along the margin of the river; and on the heights in the rear are several mounds, indicat-

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[1] Silliman's Amer. Journal of Science and Art, 1st series, XXXIV. 95.

ing that outposts may have been guarded, so as to give warning of the first approach of an enemy.

It has been observed that among the figures represented on Plate XVI. is a lizard without a tail; and we found, on the high ground immediately south of the little village of Big Bend, two, which may be considered as turtles, with a similar deficiency. (Plate XVII. No. 3.) They closely resemble the forms described by Mr. S. Taylor.[1]

One of these (on the east side of the river) is apparently a group of two large and four small mounds united into one (Plate XVII. No. 4); or we may suppose the two largest united by a ridge, and the four smaller ones placed adjoining them. In each of these figures one end is larger than the other; thus indicating which was the head of the turtle. One is sixty-five feet long, and sixty-seven feet broad, measured from the extremities of the anterior projections; the other is one hundred and four feet long, and eighty-two feet broad. One, it will be observed, lies nearly north and south, and the other nearly east and west. The most southerly is the largest. May they not have been the depositories of the remains of some distinguished family, consisting of the man, his wife, and four children? We may suppose that each had a mound erected suitable in its dimensions and relative position to the dignity of the person. Thus, the father would occupy the largest, and the children the smallest of the group.

The four mounds on the border of the prairie at the south part of Plate XV. may originally have been of imitative forms, but they are now much obliterated. From these the observer commands a distant view towards the south and southwest. In digging the well near by, sticks, and logs of cedar, or tamarack wood, were found at the depth of nineteen feet below the surface.

Waukesha is the next place which seems to have been occupied by the ancient inhabitants. It was formerly known as Prairie Village or Prairieville; and being on the main road west from Milwaukee, its mounds were early brought into notice. Their general distribution and relative situation, as well as the topographical features of the locality, will be found represented on Plate XVIII. It will be noticed that they occupy three different levels: those in the lower part of the village, mostly conical, are on the lowest ground; while those in the upper part are on what may be called the second bank; and the others are on the highlands east and south of the village.

Plate XIX. represents a group of works surveyed in 1836, with the assistance of Mr. Wm. T. Culley. At that time the log-house near these mounds was the only evidence of civilization in the place; and the works were uninjured by the white man, except that the large mound was made use of for a root-house, or potato-hole. The turtle-mound was then a conspicuous object; and such was its resemblance to that animal, that it was pronounced a good representation by all who saw it. The mere outline of the ground plan, as represented in the plate, fails to convey an adequate idea of this resemblance. But it is better to give the

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[1] Sill. Journ., XLIV. 28, Plate v. Fig. 6; quoted by Squier and Davis, Smiths. Contrib., I. 130, Plate xliii. Fig. 5.

outline correctly, than to attempt a delineation of what may be supposed to have been intended by the builders.

On this mound was, at that time, a recent grave, protected by pickets driven on opposite sides, so as to cross at the top, as represented on the plate. The Indians had but recently left the place, and the trail leading from the river to their wigwams ran directly over two of the mounds. This turtle was then a very fine specimen of the ancient art of mound-building, with its graceful curves, the feet projecting back and forward, and the tail, with its gradual slope, so acutely pointed that it was impossible to ascertain precisely where it terminated. The body was fifty-six feet in length, and the tail two hundred and fifty; the height six feet.

The ground occupied by this group of works is now covered with buildings. A dwelling-house stands upon the body of the turtle, and a Catholic church is built upon the tail.

Another turtle, represented on the same plate, was found on the college grounds, and differs from the other in being concave on the back, as shown by the section. It is also less symmetrical.

Plate XX. represents a group of structures occupying the very high hill a little east of the town. It consists of two round, four oblong, one turtle, and one bird-shaped mound. Of the last an enlarged view is presented on Plate XXII. No. 1, with its dimensions. Its position is peculiar, on a steep hill-side, with its head downwards. The general outline of the figure, and the shape of the head and beak, leave no doubt that a bird was intended to be represented; but whether an eagle, a hawk, or any particular bird, must be left entirely to conjecture. It will be observed that this bird is but a modification of other forms represented on the same plate (Plate XXII. Nos. 2 and 3); a slight curvature of the wings, and the addition of a beak, being the only difference: and this gradual passage of one kind of mound into another is often noticeable, as we shall have occasion to show elsewhere.

The very fine group, half a mile south of the town (Plate XXI.), fortunately is upon the grounds of Carroll College; and we may, therefore, hope it will be for ever preserved as a record of the past. These mounds form a *quasi* inclosure, and hence, like many other groups of works, have been, by casual observers, called a fort. If we were not well acquainted with works of defence in Ohio and elsewhere, which show that the mound-builders were considerably advanced in military arts, we might suppose this was intended for a rude fortification; but we can only regard it as an accidental arrangement, and not designed for any such purpose.

Much of the ground about Waukesha was, in 1836, covered with "Indian corn-hills," or remains of their recent culture of maize. In this locality, as at numerous others, the mounds occupy the highest ground and the points of hills and other places, whence the most extensive view, both above and below, can be obtained. The town of Waukesha stands on a slightly undulating plain, surrounded by hills, forming a fine amphitheatre, which, in ancient times, was doubtless crowded, as it is now, with a numerous population.

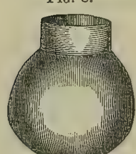
The mound marked *a* on the map (Plate XVIII.) was selected for examination; much of the earth having been removed by the town authorities, so as materially

to lessen the labor. At about two feet above the original surface of the ground, the top of a circular wall or pile of stone, about nine feet in diameter, was discovered. It was composed of loose fragments of white limestone, which exhibited evidence of long contact with the earth, by their decayed and softened exterior. The wall was interrupted on the west side. (See Section, Plate XVIII.)

We commenced the exploration by opening a trench three feet wide, beginning on the east side of the original mound, deep enough to reach through the black and mottled earth of which the mound was composed, and to the surface of the yellowish clay subsoil. Continuing this trench towards the centre, we passed the loose stone wall, and found the black earth suddenly extending down about two feet below the natural surface of the ground, and reaching the gravel below the yellow clay. Upon this gravel, two feet below the original surface, directly under the centre of the mound, and surrounded by the circular heap of stone, was found a human skeleton, lying on its back, with the head towards the west. Stones had also been placed at the sides and over the body, forming a rude sort of coffin. The bones were very much decayed, and only fragments could be obtained. The plates of the skull were too far gone to be restored.

In the left hand was a pipe of baked clay or pottery, ornamented with holes around the bowl, and also a quantity of red paint. In the right hand was a smaller pipe, cut from a soft kind of stone. They are both very small, and appear to have been articles of fancy, rather than use. At the head were found many fragments of pottery which had been crushed by the weight of the earth; these fragments were originally portions of two vessels, which had the form represented in Fig. 8. They are of the same coarse and rude materials as the fragments so frequently found on and near the surface in many localities throughout the State. The earth immediately over the skeleton was hard and black, indicating the action of fire, though no other evidence of this was discovered. Fragments of fresh-water shells (of the genus *Unio*[1]) were found with the fragments of pottery. No wood was found, nor were any vacant places noticed where it might have decayed.

Fig. 8.



Another mound was opened a short distance west of the first, by sinking a shaft in the centre five feet in diameter. We soon reached burnt clay, of a yellow or reddish-yellow color, with stones almost calcined into quicklime by the intensity of the heat. Much charcoal was obtained, showing still the original pores and concentric circles of the wood, which appeared to be oak. The bones of a portion of the leg of a human being were found; but the remainder of the skeleton had evidently been consumed at the time of the interment. There had been no excavation below the natural surface of the ground in this case.

The materials composing these mounds were taken from the surface, so that no perceptible excavations are left in their vicinity; and the whole body of the tumulus consists of black mould, with occasional spots of yellowish clay. The difference between the artificial and natural soil was quite apparent. No articles

[1] Apparently the *Unio siliquoides* of Barnes.

of ornament or use, indicating any commerce with the white race, were discovered; and we are led to the conclusion that the mound was erected before the discovery of the country. The position of the skeleton, and other indications, show conclusively that no disturbance had taken place since the interment, and that the articles obtained were the original deposits. The skeleton was, without doubt, that of the personage for whom the mound was erected.

In one of the vases at the head of the skeleton were the remains of a shell, apparently the *Unio siliquoides*, a very common species in the rivers and lakes of Wisconsin. These shells are often used for spoons; and this vase probably contained a supply of food for the departed while on the journey to the spirit-land.

It is impossible to estimate, with any degree of precision, the length of time that human bones may have remained when placed two feet in the earth, and covered with a mound still retaining an elevation of four feet; but it is certain that all traces of them would be gone in a few centuries, unless they were longer preserved by peculiar circumstances. The skeletons found here were, as before stated, very much decayed; but it is believed that their antiquity could not be very great. Roots of trees had penetrated to the bones, and drawn nourishment from their mouldering remains, thus hastening their decay; and their depth (four and six feet) below the top of the mound, was not so great as to exclude entirely the effects of moisture, especially in wet seasons. It is true, the hard layer of earth and the covering of stone had a preservative influence; but, upon the whole, it is not probable that these mounds have an antiquity of many hundred years.

It is clear, then, that this was one of the latest works of the mound-builders; one that connects them with the present race of Indians; and yet its origin is, without doubt, anterior to the discovery of America. The pipes, the red paint, and the pottery, are so many circumstances connecting this mound with the recent race; while the tumulus itself is a relic of the more ancient one of the mound-builders. The progress of discovery seems constantly to diminish the distinction between the ancient and modern races; and it may not be very wide of the truth to assert that they were the same people.

It is not strange that changes should, from time to time, take place in the character and habits of a people so rude and so little advanced in civilization. Different tribes have different habits; and a stronger one may have overrun and swallowed up a weaker, and thus changed its customs and destroyed its institutions. In this way the mode of burial, and even the religious ceremonies, may be altered; those of the conquerors being substituted for those of the conquered. History records many such events. The inhabitants of Egypt have ceased to build pyramids and sphinxes; the Greeks have ceased to erect temples: and yet, we have reason to believe that their descendants occupy the same countries. Is it more strange that the ancestors of the present Indians should have erected mounds of earth, than that the aboriginals of any country should have had habits different from their posterity? We need not, therefore, look to Mexico, or any other country, for the descendants of the mound-builders. We probably see them in the present red race of the same or adjacent regions.

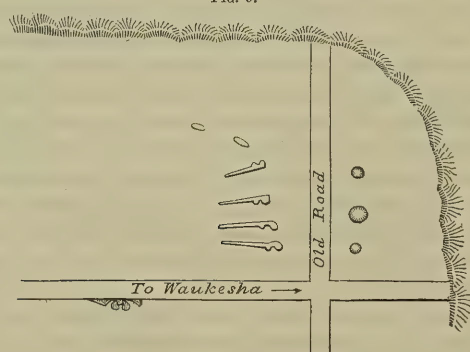
Since the red men have become known to us, numerous tribes have been ex-

tinguished, with all their peculiar customs and institutions; yet, as a whole, the Indian remains. Many tribes have been overrun by others, and have united with them as one people. Migrations have taken place; one tribe acquiring sufficient power has taken possession of lands belonging to another, and maintained its possession. In the course of these revolutions it is not strange that habits and practices, once prevalent in certain places, with certain tribes, should become extinct and forgotten.

Another fact is important in this connection. The mound-builders occupied the same localities that are now the favorite resort of the present Indians, who still often make use of the mounds for the burial of their dead. They have a kind of veneration for them, which may be the result of a lingering tradition of their sacred origin. The implements and utensils of the mound-builders were the same in many cases as those used by the recent inhabitants before their intercourse with the whites; and, as it has been quite clearly shown that the latter have in former times erected mounds of earth over their dead, we may consider such facts as tending to prove the unity of these people.

A mile and a half above Waukesha, on a very high and commanding position, are three round mounds in front of four "lizard-mounds." (Fig. 9.) They are

Fig. 9.



at the crossing of the old "Madison road," in the southwest quarter of section twenty-six. A sentinel stationed on them could give warning to the inhabitants of the approach of any hostile force, long before they could reach the village. The "lizards," as in most other cases, have their heads towards the south.

On the northwest quarter of the same section are also some small mounds, and one of the lizard shape. They are at the foot of the hill that borders the outlet of Pewaukee Lake. Still further, on the road (S. E. qr. of Sec. 22, T. 7, R. 19), were found the remains of another lizard mound, now nearly destroyed.

But the most remarkable collection of lizards and turtles yet discovered is on the school section, about a mile and a half southeast from the village of Pewaukee. (See Plate XXIII.) This consists of seven turtles, two lizards, four oblong mounds, and one of those remarkable excavations before alluded to. One of the turtle mounds, partially obliterated by the road, has a length of four hundred and fifty

feet; being nearly double the usual dimensions. Three of them are remarkable for their curved tails, a feature here first observed. (Plate XXIV. Nos. 2, 3, and 4.) One of the smallest has the tail turned back by the side of the body. (Plate XXIV. No. 4.) These curved figures have another peculiarity in the obtuseness of the extremity; the end being round and flat, instead of a sharp point, as in most other similar mounds. While these have a width of about four feet at the end, others so gradually diminish in height and breadth that it is almost impossible, as before observed, to determine the precise point of termination. One has a rectangular bend at the extremity of the tail, and in each there is a change of direction in passing from the body to the tail.

The excavation, Plate IX. Fig. 6, is quite similar to those found on the Milwaukee River, in form and dimensions; except that the extremity is deflected, and it does not appear to be associated with the principal mound by pointing towards it. The oblong structure adjoining the excavation is in the most conspicuous place, and may be styled the "observatory."

This interesting group occupies a secure position, being on a ridge flanked by marshy grounds on either side. At the remote period when these mounds were built, the marshes may have been lakes, since filled up or dried away to their present condition.[1] A diligent search did not reveal any evidence of breastworks, or other means of defence, across this ridge at either end of the mounds. About half a mile off, in a northwest direction, is a very high hill (probably two hundred feet above the level of the marshes), on which are one lizard and three circular mounds. From these there is a fine view, extending over much of the adjacent country.

It will be noticed that there are no round or burial mounds among those represented on Plate XXIII. The cemetery was in some other place, probably on the hill just mentioned. The grounds about the former are covered with scattered oak-trees, commonly called "oak openings," and thickly overgrown with small bushes, rendering it difficult to perform the work of surveying. Such was the density of this undergrowth, that we seldom could see a mound until we were directly upon it; and we are not sure that all were detected. At the time of our visit a fire was raging through the woods about us, consuming the dry leaves and brush, and filling the air with smoke; and our clothes and persons soon became blackened by the charred bushes, nor were we entirely free from danger arising from falling trees. The peculiar noise made by the fire as it entered the marsh, caused by the bursting of the hollow stems of coarse grass and weeds, was very great.

Traces of a few other mounds were noticed at the eastern extremity of Pewaukee Lake, immediately north of the village. They were too much injured in the process of making roads, and by the dam, by which the lake has been raised four feet above its original level, to admit of their precise nature being ascertained.

No other ancient works could be found in the valley of the Pishtaka and its branches; nor could we hear of any more upon inquiry among those familiar with the localities in that part of the country.

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[1] They are 260 feet above Lake Michigan, as ascertained by levelling.

CHAPTER III.

ANCIENT WORKS IN THE BASIN OF ROCK RIVER AND ITS BRANCHES.

SECTION I.

BELOW AZTALAN.

The Rock River country is favorably known as among the most fertile and beautiful in the broad West. The early settlers were eager to reach this valley; and it has now become the centre of a numerous, thriving, and intelligent population. It occupies the central portions of the southern and most populous part of the State; having an area of five thousand five hundred and fifty square miles. At Beloit, where the river passes into Illinois, it has an elevation of one hundred and thirty-eight feet; and the rim of the great basin is from three hundred to eight or nine hundred feet above the level of Lake Michigan.

Ancient works exist in this valley below the State line; but of their nature and extent I have been able to obtain no very particular information. It is believed that they are of less importance than those to the north; and, with the exception of some of the turtle form as far south as Rockford, they do not assume those peculiar imitative figures so characteristic of the mounds of Wisconsin. North of the State line, the mounds are profusely scattered over this broad valley (as will be seen by reference to the map), reaching to the very sources of some of the branches.

The following statement is from the "Narrative of an Expedition to the Source of St. Peter's River," &c., under the command of Captain Long, in 1823:

"On both banks of the Kishwaukee, not far from its mouth, there are many mounds in every respect similar to those met with on Fox (Pishtaka) River, but scattered along the bank without any apparent order. Mr. Say counted upwards of thirty of these mounds. It is probable that they were the cemeteries of a large Indian population, which resided along the banks of the Kishwaukee, and which, perhaps, had its principal village at the beautiful confluence of this stream with Rock River."[1]

Only one locality of any importance was found on the Pekatonica, a branch of Rock River that has its rise in the centre of the lead-mine region, where ancient works had been constructed. The necessities of these builders probably did not include lead, for in this region but few works are seen; and we find no indications

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[1] Narrative, &c., I. 185. See also Chap. II. p. 23, of the present work.

of ancient mining as at the copper mines of Lake Superior. The copper ore associated with the lead was beyond the reach of their metallurgic arts. The works alluded to are sketched on Plate XXV, and consist of several oblong, or circular, and one tapering mound; the last destitute of appendages, or other indications of its relation to the turtle and lizard forms, found further east.

They are situated on the sloping ground, and extend from the top of the hill half way to the river. The soil is here sandy, being in the district of the sand-stone, which is seen cropping out along the road near by. There is nothing to distinguish them from others more within the proper region, as it were, of the mound-builders. One of them had been opened prior to our visit, from which bones were said to have been obtained. Indian graves while exposed along the margin of the river, furnished a few glass beads and some trinkets.

The valley of Sugar river, a considerable stream between the Pekatonica and Rock rivers, appears also to have been avoided by the mound-builders. We could hear of only a few unimportant mounds on sections fourteen and fifteen, township four, range seven; and on thirty-five and thirty-six, township four, range six. None could be heard of about Monroe and Exeter, where lead is dug in considerable quantities. For some unknown reason, they seem not to have occupied this mineral region.

A few mounds of no great interest were seen about Delavan lake, also in and near Beloit, which were not minutely examined by me, but have since been surveyed by Prof. S. P. Lothrop, of Beloit College. (See Plates LIV, LV.) Proceeding up the immediate valley of Rock river, the first works worthy of note are near the junction of the outlet of the four lakes at Fulton.

Plate XXVI represents the works at a place known as Indian Hill, about a mile above the mouth of the outlet. Here is a series of oblong mounds on the steep slope of the hill, converging towards a point where there is a dug-way leading to the river. The hill has an elevation of seventy or eighty feet, and from its summit the valley of the river can be overlooked for several miles above and below. It may be that this was one of the most important posts of observation, and that the peculiar arrangement of the mounds was intended to guard the access to the water from the top of the hill.

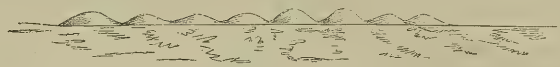
The hill is quite steep, and at present covered with trees and an under-growth of hazel-bushes. The graded way has been increased in depth by running water, but it bears evidence of having originally been constructed by art.

At the intersection of Main and State streets, in the village of Fulton, is an irregular oval earth-work, consisting of a flat ridge, and resembling the road-way of a modern turnpike. (See Plate XXV, No. 2.) The breadth varies from thirty to forty feet, and the elevation from two to three feet in the middle. The diameters of the oval are five hundred and three hundred feet. Such a structure might have had its uses in some of the public games or ceremonies of uncivilized life; but it would be idle to attempt to ascertain its particular purpose.

Besides the works already mentioned in this vicinity, there are numerous tumuli of the ordinary circular form, supposed to be sepulchral. They are occasionally

arranged in rows, more or less regular, along the margin of a brook or valley, as shown by Fig. 10. Usually two or three mounds near the middle of the row are larger than the others.

Fig. 10.



Row of Mounds near Fulton.

Three are found on the east side of the outlet, half a mile below Fulton, and a group a mile above the town. Two miles above, on section eleven, is a group of eight (see Fig 10), situated on the edge of a prairie, so as to be seen in profile, as represented in the figure. About a mile below the village, there is a group of fourteen, and another on the side of Rock river. All these are circular mounds, unaccompanied by others of imitative forms, &c. Some have been opened, and are said in most cases to have contained remains of human skeletons, frequently of several persons in the same tumulus.

We visited the mounds noted by the surveyors of the public land near the northeast corner of the town of Dunkirk, in Dane[1] county. When seen from a distance, they might readily be mistaken for a group of large, ancient, artificial mounds: but closer observation shows that they are only abrupt natural swells or elevations, here very numerous, which have been aptly compared to the waves of the sea.

Fig. 11.

Natural Mounds, northeast corner of the town of Dunkirk, Dane county, Wisconsin.

The sketch (Fig. 11) was taken with the aid of a card, in the centre of which was a square opening crossed by threads, so as to form little squares, as recommended by Mr. Parrot.[2]

A few miles above Fulton, the river expands into a broad and shallow lake, known by its Indian name of Koshkonong, said to mean "the lake we live on." It is eight miles long, with an average breadth of two miles and five eighths; the periphery, measuring all the sinuosities of the shore, is twenty-eight miles and three quarters; the area, twenty-one square miles. According to the report of Capt. T. J. Cram, there is a rapid current, extending about six hundred feet into the lake, with a depth of water of only from two to three feet. In the other portion of the lake, on the usual channel or track for boats and rafts, the water is from four

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[1] Not *Dade* county, as spelt in Vol. I. of Smithsonian Contributions.

[2] Journey to Ararat, &c.

to twelve feet deep. At the time of our visit (July, 1850), wild rice[1] was growing abundantly over almost its whole surface, giving to it more the appearance of a meadow than a lake. Fish and mollusks also abound in its waters, finding plenty of food in the warm mud beneath, and among the roots and stems of the grass and rushes.[2]

This locality being thus abundantly supplied with the means of subsistence relied upon in a great degree by the American Indians—rice and fish—we were not surprised to find numerous traces of Indians on the banks of the lake, which are known to have been occupied until a very recent period. There are two prominent points projecting into the water from the south shore, which were favorite spots with the natives. At the easterly point, called Bingham's Point, bones of fishes, with shells (various species of *Unio*), are very abundant, enriching the soil by their gradual decay.

On these points were also found remains of pipes, copper kettles, rusty gun-locks, and knives of old fashioned forms, nearly destroyed by rust and decay. From the other, or Thebean Point,[3] we obtained arrow-points, and a triangular ornament of stone, which had probably been brought from Ohio.

On Thebean Point are traces of mounds; and a little further up the lake commences a series of works extending about two miles along the high lands which border upon that portion of it. Some of these works are represented on Plate XXVII.

As in other cases, it will be noticed that the turtles have their heads turned towards the lake, and in a southerly direction. They differ from those heretofore described, in the more eastern portions of Wisconsin, in the diminished length of the tail. It will be observed that there are several mounds of forms varying from those before mentioned in this work. The one at *a*, of which an enlarged plan is given on the plate, with its dimensions, may be deemed a modification of the lizard-mounds of eastern Wisconsin. Near it is one with a slight appendix, which has been compared to a tadpole. Next to this is a tapering mound, with a slight curve at the smaller extremity. The three, connected by a ridge that extends beyond them in both directions, are quite peculiar. Unfortunately, the lateness of the evening prevented our making a triangulation of the three-pronged mound at the top of the plate; a circumstance which we regretted less from having previously surveyed several of the same kind, hereafter to be described.

As happens in many other cases, these mounds are placed on high and commanding situations; evincing a taste for beauty of scenery, or a watchfulness, perhaps, rendered necessary by the proximity of enemies. The ground is very uneven, presenting many prominent swells, occupied by the most important mounds, and numerous depressions in the surface, usually of an oval form, caused, perhaps, by the carrying away of soft materials from below by running water; thus leaving the surface unsupported, and ready to sink into pits or depressions. They are now

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[1] *Zizania aquatica*, Linn. [2] *Scirpus lacustris.*

[3] Thebean Point is separated from the main land by a broad marsh, which is not the case with Bingham's Point.

covered with trees, shrubs, and herbage, as are also the other grounds in the vicinity.

Fort Atkinson is the name of a flourishing village on Rock river, a little below the mouth of Bark river. In this vicinity are several groups of mounds, usually in irregular rows, three or four at a place. Some very large burial tumuli, half a mile below the town, on the right bank of the river, have been opened by citizens of the place. One, the largest, is ten feet high and sixty feet in diameter, composed in part of gravel, taken doubtless from the bed of the river, but mixed with the black earth of the surface.

Graves of Indians were passed in penetrating this; and at the bottom was a cavity lined with clay, hardened apparently by water, with an impression, as was supposed, of the rough exterior surface of oak bark, as if a log of this wood had been buried, now entirely decayed and gone; or, perhaps, it was a skeleton enveloped in bark for interment. It will be remarked that, in opening mounds and penetrating to the original deposits, but few implements or ornaments of any kind are found. In this respect, the Wisconsin mound-builders differed from their successors, who are in the habit of burying articles of supposed value and utility with their dead; and from this fact it may perhaps be inferred that they had less material notions of the spirit world, or at least of the necessities of those who were on the journey to that happy land.

Half a mile below the group of circular mounds last referred to, is the remarkable succession of works represented on Plate XXVIII, No. 1. The excavation has been before alluded to. (See pages 15 and 18.) In its general character it is precisely like those near Milwaukee, and the one on the school section at Pewaukee. (See page 31.) In shape it very much resembles some of the figures that have been denominated lizards. (See Plate IX, Fig. 7.)

Are we, then, to consider this as of the same origin, formed in the inverse order, and for similar purposes as the mounds? As at Milwaukee, a large mound stands near the smaller extremity.

These works are situated on the immediate bank of the river, which here has an elevation of ten or fifteen feet. The irregular cross at the west end of the group is quite peculiar, as are also the elongated and tapering mounds at the opposite extremity, which, in shape, may be compared to the tear drop! One cross near the fence is exactly like those of Waukesha and Crawfordsville. (Plates XVII and XXII.) The road runs directly over several of these mounds, and they will soon be destroyed and forgotten. Then, the present record only can be referred to as evidence of their former existence, and of their nature and extent.

A mile west of Jefferson, the county town of the county of the same name, situated at the junction of the two principal branches of Rock river, are the works represented on Plate XXVIII, No. 2. There we find the first lizard-mounds observed on Rock river. They have the same form and relative proportions as those before described, but differ in direction, their heads being a little north of west; all those before observed having had a direction towards points of the compass lying south of east or west. Another circumstance which probably governed their direction is, that they have their heads towards the water or low grounds,

either directly or obliquely. In this respect these mounds do not differ from others.

The bird, or cross, is fifty-two feet in length of body, and one hundred and seventeen feet in alar extent, and resembles those before described. The elongated mound crossing the road to Jefferson, is remarkable for its great length; but it does not extend through the country for many miles, as is represented by some casual but positive observers. The exact length, as ascertained by the tape-line, is, as marked on the plate, four hundred and twenty-five feet. This mound is called "the snake," which it resembles in form, though being exactly straight, it does not at once convey the idea of a serpent. If other mounds are termed lizards, frogs, or turtles, surely the mounds of this form are entitled to an equally distinct name.

But what most distinguish these mounds from others, are the two raised or graded ways leading to prominent points on the steep bank of the river. They have, like the ring at Fulton (see page 33, Plate XXV), about the form and dimensions of the road-bed of a modern turnpike. It would be impossible, in the present state of our knowledge of the habits and customs of the authors of these works, to form a reasonable conjecture respecting the purposes of these graded ways. At their upper extremity they are guarded on each side by mounds.

The works under consideration are situated on one of the very remarkable series of diluvial ridges, so common in the upper portions of the Rock river valley, and to which it will be necessary frequently to refer in the following pages. The river has cut away the base of the ridge at this point, so as to present an almost perpendicular cliff of clay and gravel. A little east of the works the ground descends towards the east; but the mounds are either on the summit or on the western slope. The ridge runs a little east of north, and west of south; preserving, in this respect, a general parallelism to the whole system of ridges. There were numerous other ancient works in and about Jefferson, now mostly destroyed. The ridge on which the village is built, as well as the next one towards the east, were formerly covered by a series of them, traces of which are still to be seen in the court-house square. The high bank of the river on the west side above the town, had its group of mounds, serpents, and other effigies. The story of there having formerly been a mound here of the human shape is probably not correct; at least we could not find it, nor learn anything of its whereabouts. Among these mounds there were probably none presenting new forms.

On the banks of a small lake, called Ripley lake, ten miles west from Jefferson, is a group of works represented on Plate XXIX. It will be seen to exhibit some peculiar features, though the mound representing an elephant, said to exist here, could not be found. The two figures near the middle of the group may be considered as in an attitude of defiance or of combat. The elongated embankment to the east is cleft in such a manner as to suggest very readily the idea of a serpent with its mouth slightly opened. These works are on the north bank of the lake; and similar ones extend at intervals along the shore, occupying the higher points, for a distance of half a mile.

The lake is a mile and a half in length; and covers an extent of four hundred

and ninety-three acres, with a coast line of four miles and three eighths. It is a fine sheet of pure water, with banks sufficiently elevated to present a picturesque and beautiful scene; and, at the time of our visit (July 4, 1850), the neighboring inhabitants were enjoying a sail upon its smooth surface. It has a prominent cape jutting in from the south, giving variety to the appearance of the shore; and glimpses of farm-houses, seen through the trees on the bank, show that this lovely spot is a favorite place with the modern civilized, as it was with the ancient barbarous people. Nature touches chords in the human heart that vibrate alike in the breasts of all, however different their conditions of life.

Bark river is a considerable tributary of Rock river, entering it at Fort Atkinson. Towards its source are some remains deserving notice. The most extensive group is on the fine level prairie at Summit, represented on Plate XXX. This plain has an elevation of about three hundred feet above Lake Michigan, is very fertile, the soil being two feet deep, and based upon an extensive bed of white limestone, gravel, and sand. It is bordered on all sides by small but very beautiful and picturesque lakes. Some prominent points of the series of hills passing through the State can be seen towards the southeast from this plain.

The mounds are circular and oblong, with occasionally one of imitative form; but nearly all have been ploughed over, so that it is now quite impossible to trace their exact outlines. One appears to have had the bird form. There are one or two resembling lizards, and several of them turtles. Two of the latter were here found with the head in a northerly direction, being on the south side of the lakes; showing that the object was to direct the head towards the water, rather than towards the south. (See Plate XXIX.) Several are simple ridges, gradually diminishing from one end to the other, and may be intended to represent the serpent; they do not differ from the tails of the turtles and lizards. One of unusual length was noticed near the line between sections fourteen and fifteen.

On the southwest quarter of section fourteen, is a natural elevation, formed, probably, by a ledge of limestone beneath, on which is a group of four mounds—two oblongs, one lizard, and one turtle; the feet of the latter appeared to have been curved forward. They were much effaced by cultivation.

Several mounds had been opened, but I could not learn that any discoveries of interest had been made; nor have any articles of importance been thrown up by the plough. In such cases we may suppose that the place was not abandoned, or the people drawn off in haste; but that they had time to gather up and remove all light articles.

A short distance above Hartland, on the east side of Bark river, immediately north of the burying-ground, is a series of oblong mounds, one of which is enlarged at the extremities and in the middle, as shown in the figure. (Plate XXXI, No. 1.) This appears to be a form intermediate between the plain oblong and the more elaborate animal-shaped mounds. The turtle at the northern extremity of this group is nearly destroyed by the road. These works are on the southeast quarter of section twenty-six, township eight, range eighteen.

Two miles and a half further up the river, at the village of Merton (northeast quarter of section twenty-four, township eight, range eighteen), are a number of

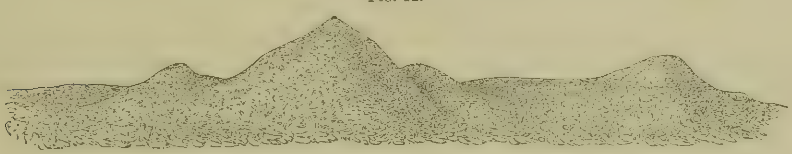
circular and oblong elevations, and one called "the cross." (See Plate XXXI, Nos. 2 and 3.) This last is certainly entitled to the name, from its striking resemblance to the cross as emblematically used and represented by the Roman Church in every part of the world; and yet there can be no doubt that this mound was erected long before the first Jesuits visited this country, and spread the doctrines, and presented the emblem of the Christian faith.

The ground here is high, and there are ridges running along the plain, as shown on the map. An excavation had been made in the cross at the intersection of the arms, and bones found of a large size, probably of some Indian who had been buried there.

Mr. Miller, who resides near here, gave us a stone instrument, called by him a "skinner;" for, said he, "I have seen the Indians use a similar instrument in skinning a deer in the State of New York." It is a beautiful green stone, well polished towards the sharp end, showing, perhaps, that it had been much used.

The place just above the village, called Fort Hill, has on it two oblong embankments, but bears no resemblance to a work of defence.

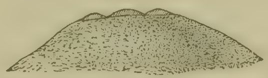
Fig. 12.



Lapham's Peak (as seen from the south).

North of Merton we left the main road to ascend a very high, conical, isolated peak (on section fifteen, township eight, range eighteen), in the west part of Washington county. It is composed of drift materials, no solid rock being observed. Towards the summit gravel only is found, the pebbles being mostly limestone. In its general appearance this peak resembles the Blue Mounds in the mineral region further west, though on a smaller scale. (See Fig. 12.) We found three artificial mounds occupying the whole of the narrow summit of this remarkable peak, as shown in the figure. (Fig. 13.) The middle and largest of these was

Fig. 13.



Enlarged view of the Summit (as seen from the west).

opened, and proved to be composed of black vegetable mould, covering a base of stone; but nothing could be found to show for what purposes they were erected. Whatever these purposes may have been, they were clearly of much importance to those who built the mounds; for the labor of transporting the stone and soil from the plain below up so steep an ascent, must have been very considerable, and not likely to be undertaken for any trivial object. The central mound was six feet in height; the others, four.

A mean of seven good observations with the barometer, gave for the elevation of this peak above Lake Michigan . . . . 824 feet.

Add height of that lake	578 "
Total height above the ocean . . .	1402 "

The height above the surrounding grounds is about 275 feet.[1]

In the vicinity of the Four Lakes, where Madison, the capital of the State, is situated, the mound-builders have left unusually numerous traces of their former occupancy and industry. The lakes are united by a stream called the Catfish, through which the waters are conveyed to Rock river at Fulton. The mounds situated six and twelve miles west of the Four Lakes were among the first of the animal-shaped mounds of which an account was published;[2] and as I have no additional facts to communicate in regard to them, a reference to the places where they are noticed and very fully described, is all that is now required.

A figure on the third lake, within the limits of the town, was fortunately rescued from oblivion by Mr. F. Hudson, whose very accurate drawing I was permitted to copy from the papers belonging to the Wisconsin State Historical Society. (See Plate XXXII, No. 1.) It will be seen that it differs from any mound heretofore described, in having a neck and a proportionately smaller body. Like most mounds of this general character, it has its head directed towards the water. It occupies high ground, having a gentle slope towards the lake, and is very near the steep broken cliff.[3]

Along the road to Munroe (on section twenty-two, township seven, range nine), north of the small lake called Lake Wingra, is one of the rows of mounds so often alluded to, and which is represented on Plate XXXII, No. 2. The difference in their relative size may indicate the different degrees of dignity of the persons in whose honor they were erected. The row is irregular, being accommodated to the shape of the ground. It occupies one of the highest places about the lakes. Two quadrupeds, one bird, one mound with lateral projections, five oblong, aud twenty-seven circular tumuli, make up this group.

Plate XXXIII represents what still remain of the works near the south angle

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[1] In consideration of the interest manifested by Mr. Lapham in this prominent feature of this part of the State, by measuring its altitude, and opening its artificial mounds, it has been proposed to name it Lapham's Peak.—*Secretary S. I.*

[2] R. C. Taylor, Silliman's Am. Journal, XXXIV, 92, Plate i, Fig. 1, Plate ii, Figs. 2, 3, and 4. John Locke's Report, pp. 136, 139–42, Plate, iii, iv. Squier and Davis, Smithsonian Contributions, p. 125, Plates xl, xli, and xlii.

[3] The following are the dimensions as given by Mr. Hudson:

Total length	318 feet.
Length of head	33 "
Length to first pair of legs	63 "
Length to second pair of legs	105 "
Breadth of head	27 "
Breadth of neck	21 "
Breadth of body	40 "
Diameter of the mounds	42 "

of the third lake. Here the rows present more the appearance of order and system than those of any other locality surveyed. The rows of smaller mounds parallel with the principal range, may have been for persons of inferior grades belonging to the families buried in the larger ones. The parallel ridges are upon ground sloping considerably towards the lake; and rise one above another, like the seats of an amphitheatre, to which they have been compared. The work in the rear of these ridges is quite regular, and intermediate in its character between a true cross and a bird-shaped mound.

At the foot of this slope commences a flat, extending around the east end of the lake, from which it is separated by a low, sandy ridge. Along this ridge is a very remarkable series of irregular elevations, twenty-four in number; a part of them are represented on the plate. They are largest and most abrupt towards the water, and are covered with soil and a forest of scattered trees. On several are artificial mounds, one of them a turtle; but whether they are themselves artificial seems doubtful, though it is difficult to understand how they could have been formed by any natural process. A recent Indian grave occupies the summit of one; and we noticed, near by, the poles of a wigwam but recently abandoned by the red men, though we were in sight of the capital of the State.

A ridge of sand or gravel is often formed around the margin of the small lakes in Wisconsin, by the expansive force of ice in winter; the materials near the shore being gradually moved year by year a little towards the land. But this cause is hardly adequate to the production of a series of mounds.

There are traces of other mounds south and west of those represented on Plate XXXIII, but they were too much reduced by the plough to enable us to trace them and ascertain their original forms.

On the north shore of the fourth lake, also on the first and second lakes, are said to be numerous works, which we did not visit. Eight miles northeast of Madison, the surveyors of the public lands have reported the existence of mounds (sections thirteen, twenty-three, and twenty-four, township eight, range ten), which we also were obliged to omit in our survey.

SECTION II.

ANCIENT WORKS AT AND IN THE VICINITY OF AZTALAN.

These important works are represented on Plates XXXIV and XXXV, and give evidence of greater labor than those at any other locality in the State. They are important also on account of their resemblance or analogy to works in other parts of the United States. It is the only ancient inclosure, properly so called, in Wisconsin; and although it is usually termed a fort or citadel, it will be shown hereafter that it falls more properly into the class denominated "sacred inclosures." Without this we might be led to suppose that the ancient mound-builders of Wisconsin were a distinct people from those of Ohio, so different is the general character of their monuments.

The "ancient city of Aztalan" has long been known, and often referred to, as one of the wonders of the western world. Many exaggerated statements respecting the "brick walls" supported by buttresses, the "stone arch," &c., have been made; for all of which there is little foundation in truth. The remains were discovered in October, 1836, and hastily surveyed in January, 1837, by N. F. Hyer, Esq., who soon afterwards published a brief description of them, with a rude wood-cut, in the Milwaukie Advertiser, the first, and then the only newspaper, in this part of the country. This survey was made before there were settlements in the neighborhood, and was done in a cursory manner. The brief account, however, as published, gave a very good general idea of the works; and has been the foundation of all subsequent plans and descriptions up to the present time.

Mr. Taylor's description[1] was furnished by a friend, who only made a brief visit to the works, accompanied by Mr. Hyer, and added but little to our knowledge of these ruins; though it was published in a more permanent and accessible form, and hence is more generally known and referred to. Messrs. Squier and Davis have condensed this description, and copied the plan in their work, in the first volume of the Smithsonian Contributions (page 131, Plate xliv, Fig. 1), with a number of judicious suggestions as to the nature of the walls, the object of the "bastions," &c. By comparing the plan and description thus given with what follows, the curious reader may trace the differences, and discover wherein the first fell short of presenting the whole truth.

The name Aztalan was given to this place by Mr. Hyer, because, according to Humboldt, the Aztecs, or ancient inhabitants of Mexico, had a tradition that their ancestors came from a country at the north, which they called Aztalan; and the possibility that these may have been remains of their occupancy, suggested the idea of restoring the name. It is made up of two Mexican words, *atl*, water, and *an*, near; and the country was probably so named from its proximity to large bodies of water.[2] Hence the natural inference that the country about these great lakes was the ancient residence of the Aztecs.[3]

Reference to Plate XXXIV will show that the main feature of these remains is the inclosure or ridge of *earth* (not *brick*, as has been erroneously stated), extending around three sides of an irregular parallelogram; the west branch of Rock river forming the fourth side on the east. The space thus inclosed is seventeen acres and two thirds. The corners are not rectangular; and the embankment or ridge is not straight. The earth of which the ridge is made was evidently taken from the nearest ground, where there are numerous excavations of very irregular form and depth; precisely such as may be seen along our modern railroad and canal embankments. These excavations are not to be confounded with the hiding-places (*caches*) of the Indians, being larger and more irregular in outline. Much of the material of the embankment was doubtless taken from the surface without penetrating a sufficient

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[1] Silliman's Am. Journal, XLIV, 35.

[2] J. Delafield, Jr., Antiquities, &c., p. 107.

[3] Buschmann (Ueber d. Aztek. Ortsnamen, p. 6) says the name *Aztlan* is composed of the lost word *aztli* and the local termination *tlan*.—*Secretary S. I.*

depth to leave a trace at the present time. If we allow for difference of exposure of earth thrown up into a ridge and that lying on the original flat surface, we can perceive no difference between the soil composing the ridge and that found along its sides. Both consist of a light yellowish sandy loam.

The ridge forming the inclosure is 631 feet long at the north end, 1,419 feet long on the west side, and 700 feet on the south side; making a total length of wall of 2,750 feet. The ridge or wall is about 22 feet wide, and from one foot to five in height.

The wall of earth is enlarged on the outside, at nearly regular distances, by mounds of the same material. They are called buttresses or bastions; but it is quite clear that they were never designed for either of the purposes indicated by these names. The distance from one to another varies from sixty-one to ninety-five feet, scarcely any two of them being alike. Their mean distance apart is eighty-two feet. They are about forty feet in diameter, and from two to five feet high. On the north wall, and on most of the west wall, they have the same height as the connecting ridge; but on the south wall, and the southern portion of the west wall, they are higher than the ridge, and at a little distance resemble a simple row of mounds.

On the inner side of the wall, opposite many of these mounds, is a slight depression or sinus; possibly the remains of a sloping way by which the wall was ascended from within the inclosure.

The two outworks, near the southwest angle of the great inclosure, are constructed in the same manner; but both these mounds and the connecting ridge are of smaller dimensions. The ridge or way connecting the mounds at *a* and *c*, has something of the same general character, though still more obscure. When viewed from the road, a short distance west, these outworks would be supposed to be nothing more than a few circular mounds. The connecting ridge, at least, is too insignificant to be mistaken for the walls of a fort, or other work of defence. Whether these walls are only a series of ordinary mounds, such as are found all over the western country, differing only in being united one to another, it may perhaps be difficult to decide. They may possibly have been designed for the same and for other purposes.

On opening the walls near the top, it is occasionally found that the earth has been burned. Irregular masses of hard reddish clay, full of cavities, bear distinct impressions of straw, or rather wild hay, with which they had been mixed before burning. These places are of no very considerable extent, nor are they more than six inches in depth. Fragments of the same kind are found scattered about; and they have been observed in other localities at a great distance from these ancient ruins.

This is the only foundation for calling these "*brick* walls." The "bricks" were never made into any regular form, and it is even doubtful whether the burning did not take place in the wall after it was built. The impression of the grass is sometimes so distinct as to show its minute structure, and also that it was of the angular stems and leaves of the species of carex still growing abundantly along the margin of the river. As indicating the probable origin of this burned clay, it is important to state, that it is usually mixed with pieces of charcoal, partially burned

bones, &c. Fragments of pottery are also found in the same connection. The walls and mounds are composed of a light colored clay, which becomes red on being slightly burned.

From all the facts observed, it is likely that clay was mixed with the straw, and made into some coarse kind of envelope or covering, for sacrifices about to be consumed. The whole was probably then placed on the wall of earth, mixed with the requisite fuel, and burned. The promiscuous mixture of charcoal, burned clay, charred bones, blackened pottery, &c., can only in this way be satisfactorily accounted for. The pottery was broken before it was buried, for the fragments were scattered about in a manner that clearly shows that the vessels were not entire.

A shaft was sunk by us in the sixth mound from the northwest angle on the west wall. A fragment of galena (sulphuret of lead), and another of iron ore used as red paint, and worn smooth, perhaps by long use in adorning the faces of the red men, were near the surface, and were the only articles found. No burned clay was on this mound, and we soon discovered that it is only in a few places that this substance exists. The earth was here a yellowish sandy loam, entirely free from spots of black mould; thus showing that it was built exclusively from the *subsoil* of the adjacent grounds. The builders had carefully removed the black soil before they commenced the erection of this mound. Our shaft was sunk some distance below the original surface. Two of the smaller mounds in the interior were also opened, but without results of any interest.

The mound, or projection, or buttress (whichever it may be termed), at the northwest angle of the inclosure, proved to be one of some interest. (See Fig. 14.) After

Fig. 14.

Section of the northwest corner mound, Aztalan.

removing the sods with which it was covered, we came upon fragments of pottery, charcoal, half-burned human bones, and numerous amorphous masses of burned clay scattered loosely and promiscuously about in the earthy materials of the mound. This continued to the depth of one foot only; below, the earth was quite uniform in appearance, though still showing incontestable proofs of art. Occasional fragments of clay, charcoal, and fresh-water shells almost entirely decayed, were observed as we proceeded. Still deeper we found a cavity which was nearly filled with *loose* earth, in which were indications of bones very much decayed and charcoal. This was divided below into two other cylindrical cavities, extending beneath the original surface of the ground, and filled with the same loose materials.

Two bodies had doubtless been buried here in the sitting posture, near each other, enveloped and covered, perhaps, by some perishable substances, which had decayed and left the cavity above; and this shows that the mounds at Aztalan, though constituting an inclosure, were used for burial purposes, as were other ordinary circular mounds.

Within this inclosure the ground descends towards the river more abruptly near the western wall, forming a kind of second bank, and then with a smooth even surface. This slope is interrupted only by a natural swell or eminence, shown at *c*, Plate XXXIV. The highest point in the interior is at the southwest corner, and is occupied by a square truncated mound, that, when seen from the high ground at *c*, presents the appearance of a pyramid, rising by successive steps like the gigantic structures of Mexico. (See section on Plate XXXIV.) This was doubtless the most sacred spot, as well as the highest. It will be observed that the inclosing walls curve around this pyramid, as if constructed afterwards, and made to conform to the shape of the ground. It is also further guarded by the two outer walls before described.

The level area on the top was fifty-three feet wide on the west side, where, in consequence of the slope of the ground, it has the least elevation; and it was originally, in all probability, a square of this size. On other parts of the mound the sides are high and steep; and the abrading effects of time have acted most upon the summits. There appears to have been a sloping way leading from the top of this mound towards the east; but if so, it has now dwindled to a slight elevation or swell on that side. This road-way was connected with a ridge before alluded to, extending towards the prominent point *c*. From this last point there is a gradual and easy descent to the river. These level-topped mounds may have been the foundation only of some structure of more perishable materials. From the summit of the two high places, and especially from that at *a*, the whole works, and quite an extent of surrounding country, can be seen.

At the northwest angle of the inclosure (*b*) is another rectangular, truncated, pyramidal elevation, of sixty by sixty-five feet level area on the top, with remains of its graded way, or sloping ascent, at the southeast corner, leading also towards a ridge that extends in the direction of the river. This mound occupies the summit of the ridge or bank before spoken of, though it rises but little, if any, above the top of the adjacent walls. It has been partially destroyed by persons curious in antiquarian research, and by one who, it is said, had been *supernaturally* convinced that a large amount of money was deposited in it!

There is another square structure (at *d*), which is level on the top; but as it stands on sloping ground, and has but little elevation, it runs to a grade even with the surface on the upper side. Just at this point a small mound has been erected, perhaps at a subsequent time, and by a different tribe or nation of people.

The analogy between these elevations and the "temple-mounds" of Ohio and the Southern States, will at once strike the reader who has seen the plans and descriptions. They have the same square or regular form, sloping or graded ascent, the terraced or step-like structure, and the same position in the interior of the inclosure. This kind of formation is known to increase in numbers and importance as we proceed to the south and southwest, until they are represented by the great structures of the same general character on the plains of Mexico.

In this inclosure are ridges usually about two feet high, as represented on the plan. The rings or circles connected with them constitute a very peculiar feature, and are supposed to be the remains of mud houses; the materials of the walls having fallen, leaving only a circular mound of earth to mark their original

site.[1] No ridge exists along the river bank, as represented on Mr. Hyer's plan; the steepness of the bank probably rendering artificial works unnecessary for the purposes of the builders. Some of the interior ridges, it will be observed, are enlarged at intervals; thus showing an analogy with the main walls and outworks.

There are two excavations (*e* and *f*), the first triangular, and the last circular, which, from their greater depth and regular shape, as well as distance from the walls, were probably not made in the process of obtaining materials for the structures. The excavation at *e* is so deep, and the soil so tenacious, that water stands in the bottom much of the time, affording a place for the growth of flags[2] and other aquatic plants. Perhaps the bottom may have been rendered water-tight by artificial means. Undoubtedly it was once much deeper than at present; the tendency of rains and the accumulation of vegetable matter being to fill it up. The circular excavation (at *f*) is surrounded by a ridge consisting, doubtless, of the materials thrown out in the digging.

Near this point are some springs in a small ravine cut into the bank by the passage of water to the river. This ravine serves also as the outlet of the surface water from within this part of the inclosure. A few stones left along the sides and bottom of this ravine (the force of the water not being sufficient to remove them with the lighter particles of the earth), is all the evidence that could be found of an ancient sewer "arched with stone." It is quite clear that no such arch existed; nor is there any indication that the aboriginal inhabitants of the American continent were acquainted with the nature of the arch.[3] If they were, they certainly did not apply such knowledge in the construction of any works at Aztalan.

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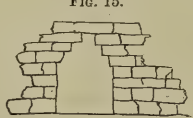
[1] We are told by Catlin that "the village of the Mandans has a most novel appearance to the eye of a stranger; their lodges are closely grouped together, leaving just room enough for walking and riding between them, and appear from without to be built entirely of dirt. They all have a circular form, and are from forty to sixty feet in diameter. Their foundations are prepared by digging some two feet in the ground, and forming the floor of earth by levelling the requisite space for the lodge. The superstructure is then produced by arranging inside of this circular excavation, firmly fixed in the ground and resting against the bank, a barrier, or wall of timbers, about six feet high, placed on end, and resting against each other, and supported by a formidable embankment of earth raised against them outside. Resting on the tops of these timbers are others of equal size, rising, at an angle of 45°, to the apex or sky-light, which is about three or four feet in diameter, answering also as a chimney. On the top of or over these poles or timbers, is placed a complete mat of willow boughs, of half a foot or more in thickness, that protects the timbers from the dampness of the earth with which the lodge is covered from bottom to top, to the depth of two or three feet, having above all a hard or tough clay which is impervious to water."—N. Am. Indians, I, 81.

[2] *Iris versicolor.*

Fig. 15.



Arched Door, Uxmal (Stephens).

[3] Even in Yucatan and Central America, where the aboriginal buildings display the greatest advance in architecture, the arch was not used; its substitute being stones laid horizontally, and made to overlap, as represented in Fig. 15.—Stephens's Yucatan, I, 429.

Nearly the whole interior of the inclosure appears to have been either excavated or thrown up into mounds and ridges; the pits and irregular excavations being quite numerous over much of the space not occupied by mounds. This want of regularity is opposed to the opinion that these excavations were for the *cellars* of buildings, as suggested by some.

In a letter from Mr. J. C. Brayton, of Aztalan, he says: "Several feet below the surface of the large square mound near the northwest corner of the inclosure was found, a number of years ago, what appeared to be the remains of cloth, apparently enveloping a portion of a human skeleton. Its texture was open, like the coarsest linen fabric; but the threads were so entirely rotten, as to make it quite uncertain of what material they were made.[1]

"Numerous fragments of earthenware have been taken from the mounds at different times: portions of broken vessels, varying in size (judging by the curve of the fragments), from a few inches to three feet across the rim.

"A number of rusty gun-locks, in scattered fragments, have been discovered at or near the surface of the ground; and pieces of iron, copper, and brass, have been found in the neighborhood. But all these, being relics of the recent Indian population, fail to throw any light upon the great questions of who made these works, and for what purpose were they constructed. The Winnebagos, the last occupants of this interesting locality, always answer in the negative by a significant shake of the head, when asked if they can tell who erected the mounds."

Mr. Brayton, who has resided in the vicinity of these works since their discovery, is of the opinion that none of the mounds have sensibly changed from natural causes since the first settlement of the country in 1836.

Our examination of the tumuli exterior to the inclosure led to no very important results. The third from the north end of the long row, seen on the plate (about four feet high and thirty feet in diameter), was penetrated to the bottom, and the opening enlarged below in every direction. A post (apparently tamarack) had been inserted, and was now all decayed, except a portion near the bottom.[2] This may have been set in since the building of the mound, which was composed of black and yellow soil intermixed, having beneath gravel composed mostly of limestone pebbles. If these smaller tumuli ever covered any deposits, they are now so completely decayed that not the least trace of them can be discovered.

While at Aztalan we were informed that upon opening one of the larger mounds some years ago, the remains of a skeleton were found, inclosed by a rude stone

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[1] This is probably the same that was forwarded by Dr. King to the National Institute of Washington.—See Silliman's Journal, XLIV, 38.

[2] This post may have been the remains of a medicine pole, such as was erected by the Mandans. According to Mr. Catlin, the Mandans were in the habit of erecting mounds of earth near their villages about three feet high, around which were arranged in circles the skulls of the dead, after their bodies had decayed on the scaffolds. On each mound was erected a pole, hung with articles of mysterious and superstitious import. Something of this kind may be the origin of the numerous smaller mounds in Wisconsin, in which no traces of artificial or human deposits could be found.—See N. Am. Indians, I, 190.

wall, plastered with clay, and covered with a sort of inverted vase of the same materials.

A number of these mounds have been opened at different times, and their contents, having been carried away to various parts of the world, cannot now be recovered.

With the view of ascertaining the contents of the larger elevations for ourselves, we selected one in Mound Street, ten feet in height, and sixty feet in diameter at the base, into which a trench four feet wide was dug, extending from the south side to beyond the centre, and down to the subsoil or stratum of gravel that underlies the superficial covering of vegetable mould.

The earth was quite uniform throughout; consisting of dark-colored mould and yellowish sandy loam, mixed in small quantities. Ashes, mingled with charcoal, were observed as we went down, and occasionally fragments of human bones. No skeleton was found; no stonework or earthenware—no stone or metallic implements of any kind could be discovered. Bones of some burrowing animals, and the remains of a fish were taken out. Fragments of rotten wood, apparently oak, were found at all depths. They were not charred, nor did they appear to have had any definite arrangement, but were confusedly placed, as if carelessly thrown upon the mound during the progress of its construction.

From the oft-repeated indications of fire at various depths, we could draw no other conclusion than that this was a "mound of sacrifice," and that at each repetition of the ceremony an addition was made to the height of the mound.

The gopher[1] often burrows in the artificial tumuli to find a dry place for its nest; and roots of trees penetrate to their lowest depths.

The question naturally arises in the mind of the observer, For what purpose was this great inclosure made? Mr. Hyer called it a citadel, and it is usually termed "the fort," and supposed to be a work of defence—a place to which the mound-builders resorted for safety when hard pressed by an enemy. Various reasons have been assigned for this supposition. Its connection with the river, affording a means of supply to the besieged—its buttresses or bastions—its outworks—its watch-towers—might all seem to convey the idea of a military work or a fortification.

Although when we attempt to describe these remains, the technical terms of military men are found convenient, and sometimes applicable; yet the "fort," the "buttresses," the "bastions," &c., have but remote resemblance to such constructions. Expressions like these often lead the superficial observer and reader astray, and may have done so in this case.

Messrs. Squier and Davis show very conclusively that the circular projections on the exterior of the walls could not have been intended for bastions.[2] It is equally clear that a ridge of earth twenty-two feet wide and five feet high, does not need the support of buttresses.

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[1] The name here universally applied to the thirteen-lined marmot (*Spermophilus tridecemlineatus*).

[2] Smithsonian Contributions, I, 132.

But this fort is entirely commanded from the summit of a ridge extending along the west side, nearly parallel with (see Plate XXXIV), and much higher than the west walls themselves, and within a fair arrow-shot; so that an enemy posted on it would have a decided advantage over those within the defences. This ridge would also constitute an excellent breastwork to protect an enemy from the arrows or other weapons shot from the supposed fort. As if purposely to assist an approaching enemy, a number of mounds have been erected along the ridge, affording secure hiding-places and look-out stations, very convenient to the attacking party. These may, however, have been erected at a more recent date.

Again, the large mounds of the remarkable row northwest of the inclosure are not in connection with it, but are excellent points from which to reconnoitre and annoy the occupants of the supposed fortress.

From the summit of the ridge before alluded to, as will be seen by the sections on Plate XXXV, the ground descends towards the river; so that the inclosure is on a declivity, and is thus commanded from the opposite side of the river. Here, again, as if purposely to render aid and comfort to an enemy, a breastwork is erected, extending along the margin of the stream, from behind which arrows or other weapons could be thrown directly into the fort by persons lying in perfect security.

From the skill exhibited by the mound-builders in their works of defence in other portions of the West, we cannot imagine that they would construct such a fort as this; we might at least expect that the walls would be extended so as to include the ridge parallel to it. There is no guarded opening, or gateway, into the inclosure. It can only be entered by water, or by climbing over the walls.

The only ancient work resembling this in its general features heretofore described, is that of Tuloom, in Yucatan, of which an account is given by Mr. Stephens, and quoted by Mr. Squier.[1] This is an inclosure of about the same dimensions, and bounded on the east by the sea; it consists of a loose stone wall, with watch-towers at the two west corners, corresponding with the two large pyramidal mounds at Aztalan, except that they are placed on the walls.

Mr. Stephens represents this as a walled city; but it must be admitted that only a very small city can be included in a space fifteen hundred by six hundred and fifty feet, or twenty-two and a half acres. Mr. Squier thinks that this structure was erected for some sacred object, though used, probably, as a place of defence in a last resort; and, in view of all the facts before stated, it may be inferred that the inclosure at Aztalan was intended for similar purposes, and not primarily occupied as a place of defence.

We may suppose it to have been a place of worship; the pyramidal mounds being the places of sacrifice, like the teocalli of Mexico. From its isolated situation —there being no other similar structure for a great distance in any direction—we may conjecture that this was a kind of Mecca, to which a periodical pilgrimage was

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[1] Yucatan, II, 396; Aboriginal Monuments of New York, p. 98, in Smithsonian Contributions, Vol. II. In the accompanying figure the arrow, indicating the cardinal points, is reversed.

prescribed by their religion. Here may have been the great annual feasts and sacrifices of a whole nation. Thousands of persons from remote locations may have engaged in midnight ceremonies conducted by the priests. The temple, lighted by fires kindled on the great pyramids and at every projection on the walls, on such occasions would have presented an imposing spectacle, well calculated to impress the minds of the people with awe and solemnity. That these works were designed for some such uses, seems quite probable.

Plate XXXV represents the same structures on a smaller scale, and shows their relation to the neighboring country. It will be seen that, excepting a few mounds, no other artificial works are connected with the great inclosure; nor do these present that variety of imitative forms so common in other localities. Half a mile off, in a southwesterly direction, is a square pyramidal mound, similar to those within the inclosure.

Do not these facts warrant the suggestion that the people of Aztalan, in Wisconsin, were a different people, in many respects, from those who erected the animal-shaped mounds? This location may possibly have been occupied by a colony of Mexicans; since we know that colonies were sometimes sent out by that singular people.[1]

It is much to be regretted that the efforts heretofore made to preserve these very interesting remains of the labors of an extinct race are likely to fail. At the time of our survey, a crop of wheat was growing on the south part of the great inclosure; and, in a few years, but slight traces of this part of the works will be left. The north part is still in its original condition, except where excavations have been made by persons curious in such matters, or by the *money-diggers!*

Would it not be well to select some of the more important monuments, and, by purchase of the ground, or other means, secure their permanent preservation? Unless something of this kind is done, and speedily, all knowledge of them will be confined to the scanty records of those who have attempted to describe them.

SECTION III.

ANCIENT WORKS OF THE VALLEY OF ROCK RIVER, ABOVE THOSE AT AZTALAN.

In the valley of Rock river we find no traces of ancient works for some distance above Aztalan; the first being in the town of Ixonia (section nineteen, township eight, range sixteen). Here are seven or eight mounds along the right bank of the river, on an elevated position, as usual, commanding a fine view of the river above and below. There are said to be others in the vicinity.

One of them has been opened for the purpose of making a place in which to bury potatoes, to secure them from the frosts of winter. Numbers of human bones are said to have been thrown out from near the bottom, where the earth had been hardened by some artificial process. No implements or ornaments were noticed.

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[1] Squier's Nicaragua, Vol. II.

At Wolf Point (section twenty-seven, township ten, range sixteen), in the lower part of the town of Hustisford, we observed traces of a recently abandoned Indian village, but no ancient works. Here, it is said, a great Indian battle was fought, in times long gone by; and here Black Hawk made a stand against his white pursuers in 1832.

At Hustisford a stone was shown us, which, by the aid of a little imagination, may be supposed to represent the head of a bird; and which was held in great veneration by the Winnebago Indians, who have but very recently been removed from this part of the State. It is a boulder of gneissoid granite, of accidental form, caused by the unequal decay and disintegration of the different layers of which it is composed. (See Fig. 16.)

Fig. 16.

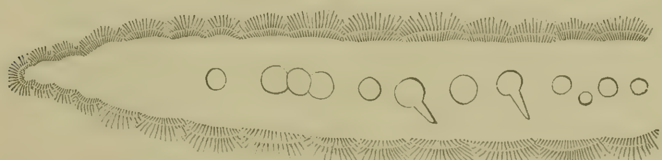
The Stone Bird.

At this place (Hustisford), there are the remains of a number of lizard mounds by the mill race, and also on the point opposite, on the east side of the river. There is a mound only two feet high, but having a considerable level area on the top, near the mill, which is said to be the place where prisoners of war were tortured and sacrificed by the Indian inhabitants. An examination disclosed partially calcined stones, ashes, charcoal, &c., in the centre.

The river here has a rapid current, caused by a ledge of limestone of the same kind as that in the lead districts of the western part of the State; the whole fall being about seven feet.

The country around is made up of a series of ridges like those before referred to, with intervening valleys, having a general direction nearly north and south. They are usually from twenty to fifty feet, and occasionally even one hundred feet in height, and frequently several miles in length. One of these ridges of great height, on the east side of the river, seems to have been selected as the principal cemetery, as we find it occupied by a series of round mounds, forming a nearly straight row along the summit. (Fig. 17.) They are so situated, that if the forest-trees were

Fig. 17.



removed, a very extended prospect could be obtained, embracing the site of the village below, and the course of the river in either direction. Three of these are partially blended at the base, and two had a slight ridge extending towards the north-east, or in a direction *from* the village; or the tadpole (the significant name of this variety of mound) was headed towards the principal works and probably main residence of the ancient population.

The lizards are here, as in most localities of a similar kind, placed with the

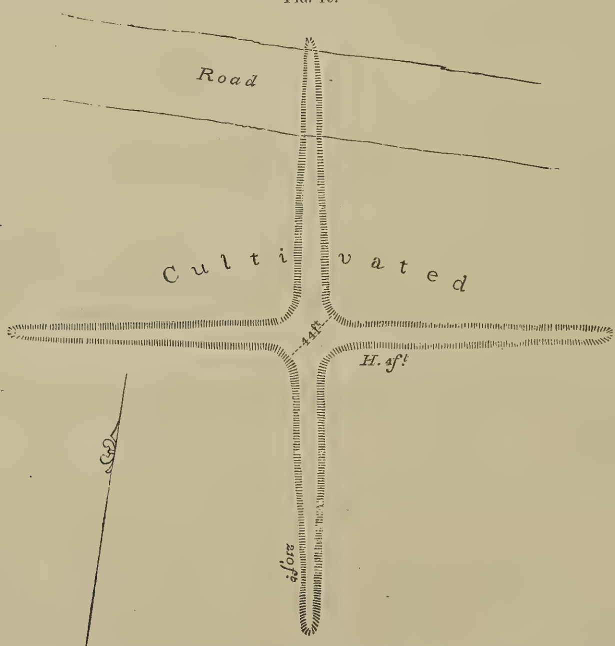
head or largest part towards the water. Among them are a number with only one projection or leg, as shown in Fig. 18.

Fig. 18.

About five miles northwest of Hustisford, on the road to Juneau, the county seat (section twenty-six, township eleven, range fifteen), is an animal-formed mound, headed southward, and a ridge about one thousand feet in length, being much longer than any heretofore noticed. The direction is a little north of east. They do not appear to be connected with other works in the vicinity.

In the northwest part of this town are a number of mounds, but presenting no varieties different from those before described; excepting one cross, which, from the uniformity and great length of the arms, appears to differ from others. (See Fig. 19.)

Fig. 19.



The Cross on section six, township eleven, range fifteen. Surveyed, 1851, by I. A. Lapham.

It is situated near the road, on the north line of section six, township eleven, range fifteen, one of the arms being crossed by it. The middle is on a gentle eminence,

so that the arms descend in each direction. Being on an open prairie, there is an extended view from this point. Each arm appears to be of about the same size and length. The plough having already commenced its work of destruction, we could not determine the proportions exactly. The compass indicated that the arms were constructed almost precisely at right angles.

These remains are on the borders of a prairie, which, from the unevenness of its surface, is denominated "Rolling Prairie." One prominent elevation has been supposed to be artificial (Fig. 20); but a little examination satisfied us that it was natural.

Fig. 20.

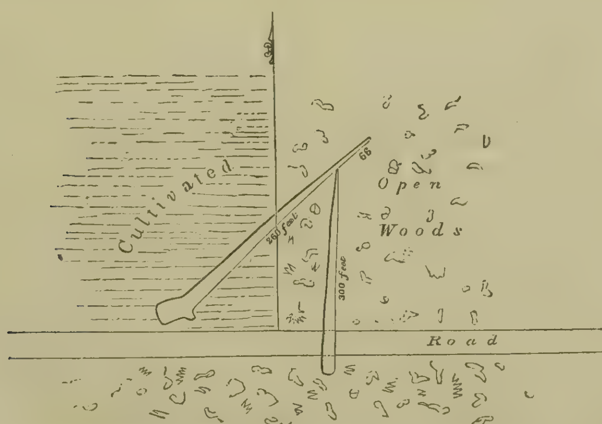
Natural Mound on Rolling Prairie.

Towards the source of the Beaver Dam river, we found numerous mounds; especially near the northwest corner of the town of Juneau (township eleven, range fifteen). On section seven are some "oblongs," one which was probably a "cross," and two others, broad and flat, with tails. These are much injured by cultivation. They occupy a broad, gently undulating plain, the margin of the Rolling Prairie.

At the village of Beaver Dam, the stream is interrupted by a dam, so as to form a pond ten miles in length, similar, in many respects, to the one at Horicon, on Rock river. On the border of this pond, a little west of the village, was a series of mounds, now quite destroyed by the road that runs directly over them. Their forms could not be made out with any degree of accuracy.

Fig. 21 represents two mounds, with a connection probably accidental, situated

Fig. 21.



on section one, township eleven, range fourteen. The effigy could not be made out in the cultivated field; but it was, apparently, of the kind called the lizard.

A few miles N. W. of this locality, on section twenty-seven, township twelve, range fourteen, is a group of various forms, mostly injured or destroyed. Their original number is estimated to have been between thirty and fifty. They were mostly of the turtle form, though some are said to have resembled the lizard, the buffalo, &c.

The works at Waushara, near the outlet of Fox lake, were on both sides of the river; but those on the east side were destroyed by the growth of the village. One circular tumulus was beautifully decorated with flowers, and will be preserved as an ornament in the flower garden of one of the citizens; a commendable instance of good taste.

On the west side of the stream is an extensive group containing a cross, oblongs, circular mounds, one of the bird form, and two that were perhaps intended to represent the elk (see Fig. 22). These are on the ridge, and along the slopes of the ridge, running parallel with the river, and but a short distance from it. Among the figures was a cross, the arms of which were oblique (Fig. 23), and one

Fig. 22.

At Waushara.

Fig. 23.

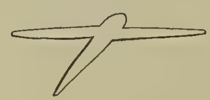


Fig. 24.

with the tail forming a tangent to the mound (Fig. 24), its outline resembling some forms of the war-club, or the modern tobacco-pipe.

The next point visited was a high bank at the northeast angle of the lake (sections eleven and fourteen, township thirteen, range thirteen), and near the mouth of a small stream. At this place are several crosses, one structure of the bird form, and numerous ridges, but not arranged with any apparent order or system. In the same locality are numerous corn-hills and "caches" of the present tribes, who still make their annual visits to the spot. We saw a flattish boulder which had been used as a sort of anvil for pounding or pulverizing corn and perhaps other substances.

Near the source of a small branch of Rock river, called the Rubicon, is a fine little sheet of water called Pike lake. The banks are low, except on the east side; and on the north side there is a group of works as sketched on Plate XXXVI, presenting some characteristics not before observed. Here is another mound with a level area on the top, being the frustrum of a cone, similar to the temple mounds, supposed to be places of sacrifice. There are three others of the ordinary form, two of the imitative forms, and a semicircular ridge embracing a circular

excavation at one extremity, and partially inclosing another. The figure at the east has but one projection or leg, and a forked tail; the other figure differs from most of the lizard-mounds in the fact that the body and tail are not in the same straight line.

The bank of the lake is more elevated at this point than on either side, where are some low grounds with springs and marshy places. A little east of this lake is a high peak or hill, which we ascended, but found no traces of ancient works on its summit.

But the most extended and varied groups of ancient works, and the most complicated and intricate, are at Horicon. Plate XXXVII represents the principal groups immediately below the town, but does not include all in this vicinity. They occupy the high bank of the river on both sides.

It will be seen that most of the forms heretofore described are represented at this place, and some are combined in a very curious manner. There are about two hundred ordinary round mounds in this neighborhood, and all, with two exceptions, quite small. The two large ones, on the west side of the river, have an elevation of twelve feet, and are sixty-five feet in diameter at the base. The others are from one to four or five feet high. In several of them we noticed very recent Indian graves, covered with slabs or stakes, in the usual method of modern Indian burial. They belong to the Potawattomies. One is protected by slabs driven in a sloping manner, so as to meet at the top like the roof of a house. Another has a kind of pen made of sticks about six inches in diameter. These graves show the peculiarity of having but one kind of wood on one grave; the slabs being made of oak, and the pen made of elm. The larger and more conspicuous mounds are generally selected by the Indians for the burial of their dead.

There are sixteen mounds of the cruciform variety. (See Plate XXXVI, Nos. 1 and 2.) They are not placed in any uniform direction—some having the head towards the north, some towards the south; nor do they appear to be turned towards the river. The form seen, Plate XXXVI, No. 1, is exactly like that of the mounds on the Milwaukee river; but that represented on No. 2 of the same plate was first observed at this place.

There is one mound, of which only a small portion appears on the plate, regularly tapering for a length of five hundred and seventy feet. At the smaller extremity it is slightly curved to the east. At its larger extremity is a large cross, and one of the largest mounds.

The animal form, Plate XXXVI, No. 3, is repeated, with slight modifications, seven times. It may be supposed to represent the otter.

If the two composite figures, one on each side of the river, near the centre of the group, are animals, performing some action, it is quite difficult to decide what the animal or the action may be that is intended to be represented. Yet it can hardly be supposed that these works were erected without design. They doubtless have some meaning which it is now impossible to ascertain.

Several of the mounds had been opened; but we could not learn of any results, excepting the discovery of human bones, and, in one case, the bones of a quadruped. We opened one of the smaller ones, and, after a careful search, could trace no indi-

cations that anything had ever been deposited beneath it. If a human body or anything else had been buried there, all traces of it had disappeared. It is difficult to comprehend for what purpose the very numerous small tumuli were made, if not for burial; and yet it is hardly probable that all evidence of such use would have disappeared. They are here commonly made of the black vegetable mould, but slightly mixed with the subsoil, which has a lighter color.

On the other hand, one of the crosses was composed of whitish earth, evidently taken from beneath the surface-soil. The animal mounds and crosses, being composed of whitish earth, can sometimes be traced in a cultivated field, even after it is ploughed down to a level with the general surface. One of the crosses immediately south of the two large mounds seen on the plate, has the arms extended quite athwart the top of the ridge, which is here flanked on one side by the river, and on the other by an extensive marsh, or natural wet meadow.

Immediately above, the river expands into a broad and shallow lake, extending twelve miles, with a mean breadth of five miles. Until recently this lake was four feet lower than at present, and was mostly covered with a floating morass. Immense numbers of fish and water-fowls are found there, and afford subsistence to the inhabitants. These advantages have probably, from the remotest antiquity, given this situation a prominence in the estimation of the various tribes or nations who have successively occupied the country. It is a fact of some importance, in deciding upon the general characteristics of the mound-builders, that they have selected the same localities as their successors, and probably for the same reasons, to wit: the greater facility of subsistence.

The beaver and otter, in former times, doubtless occupied the shores of this lake, as the muskrat still continues to do. The several sources of the Rock river run into the lake at various points, and their united waters are discharged at Horicon. It has an elevation above Lake Michigan of two hundred and ninety feet. The celebrated Sauk chief, Black Hawk, formerly had his residence at this point.

There are various interesting localities of ancient works in the vicinity of Mayville, as will be seen on Plate XXXVIII. The most extended of these is on the northwest quarter of section eighteen, township twelve, range seventeen, two miles northeast of the village. This group is shown on Plate XXXIX. It comprises thirty-five mounds of various forms, and occupies a nearly level strip between the base of a large ridge[1] and brook.

We found here one of the largest and most regular turtle-mounds we had yet seen, and three or four of the quadruped form, one of which is represented on an enlarged scale on Plate XXXIX. The two crosses are directed towards the northeast, while most of the other forms have an opposite direction. Their arms are seldom at right angles with the body, nor are the two parts of the body or trunk in the same line. The head is always largest, highest, and nearly rectangular in

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[1] On Plate XXXVIII, I have endeavored to represent these diluvial ridges, and to show how they give direction to the water-courses. It would be a matter of much interest to the geologist to determine their extent and exact nature, with the view of ascertaining, if possible, their origin. But such an investigation would be out of place in this memoir.

form. Their height corresponds with that of the other figures, it being usually from two to four feet. If these crosses are to be deemed evidence of the former existence of Christianity on this continent (as some have inferred), we may, with almost equal propriety, assert that Mohammedanism was associated with it, and, as proof, refer to the mound or ridge here represented in the form of a crescent.

Three mounds, near the north end of the group, are cleft at the extremity, like that noticed at Burlington (Plate XIII, Fig. 2). One of them might be supposed to represent a fish, and, as the finny tribe must have afforded a principal source of subsistence to the builders, it would not be surprising if they should include them in the list of animals to be thus depicted. In that case the cleft extremity should be considered as a forked tail, rather than an open mouth. The general direction of the other figures would naturally suggest the same thing, at least in this locality.

In a cultivated field, near these works, were traces of other mounds, whose nature we could not determine; they were too far gone to be restored.

Half a mile east of this extensive group is a smaller cluster, consisting of two animals and two oblong mounds. They were discovered by the engineer party in the survey of the Valley Railroad, who reported the animals as resembling the horse. Mr. Logan Crawford, Deputy Surveyor of Dodge county, made a survey and drawing of one, given on Plate XXXVIII, which, as will be seen, has but little resemblance to a horse. It was, without doubt, constructed by men who had never seen or heard of such an animal, being long before its introduction upon the American continent.

The two figures at this place are almost exactly alike, and Mr. Crawford's outline may be relied upon as correct. The dimensions were ascertained by running a line over the mound lengthwise, and then measuring at right angles from this line to thirty-six of the most prominent points in the outline. The height on the shoulders and fore-part of the body is about two and a half feet. The legs, tail, head, and neck, are not more than one foot high. Its whole length is one hundred and twenty-four feet.

Directly north of Mayville (on the northeast quarter of section fourteen, township twelve, range sixteen), on the eastern declivity, and near the base of a ridge, I saw some traces of ancient cultivation, in the form of garden-beds, with intermediate paths. In one place, where the beds were examined, they are one hundred feet long, and had a uniform breadth of six feet, with a direction nearly east and west. The depressions or walks between the beds were about eight inches deep and fifteen inches wide.

The next group of mounds noticed was at the northern extremity of a ridge near the lower dam and mills (northwest quarter of section fourteen). There were five elevations of the circular form, three of them with a projecting ridge, gradually tapering to the extremity, being of the kind called "tadpoles."[1] There are also two of the lizard form, the tail of one being in contact with the head of the other.

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[1] This form (see Fig. 18, p. 51), may possibly have been intended to represent the gourd, an ancient American plant, doubtless much used by the mound-builders.

On the adjoining tract (northeast quarter of section fifteen), are some round mounds; among them two of larger dimensions than usual, being from twelve to fourteen feet in height, and from sixty-five to seventy feet in diameter.

These several groups form a regular row, from east to west, a little north of Mayville. There is a similar arrangement at about the same distance south of the village, commencing at a group of three mounds near the centre of section twenty-six, which were very accurately surveyed and delineated by Mr. Crawford (see Plate XL)—the cross, as usual, with a direction opposite to that of the other figures, of which the central one is doubtless intended to represent the trunk and arms of the human body. The trunk is two feet high, the arms and shoulders one foot. The animal-shaped figure is brought too near this man on the plate (being ninety feet distant). It differs from most others of similar configuration in its slender form, rounded head, and recurved caudal extremity. The body is for most of its length two and a half feet high; the legs, head, and tail are one foot and a half high; but the tail gradually slopes down to about six inches at the extremity.

On the northeast quarter of section twenty-seven is a group of four mounds, of which one has the unusual form represented on Plate XXXIX. What it was designed to represent, it is difficult to conjecture.

The next group is three miles southwest of Mayville, being on the northwest quarter of the same section, and occupying the southern extremity of one of the remarkable ridges so often mentioned. The road from Mayville to Horicon passes directly by it. The general character of the figures will be understood by inspection of Plate XL. A portion were in a cultivated field, and the breaking-up plough had just been at work upon the remainder. Another year, and it would have been for ever too late to delineate them. It will be observed that all the figures of this group have their heads in one general southwesterly direction, except the cross, which, as is almost always the case, has a course directly opposite. From the extremity of the longest mound, which is on the highest ground, a general view of the whole is obtained; and this may, perhaps, be regarded as the watch-tower or look-out station. It is four hundred feet long.

On section thirty-three, near Horicon lake, are also some mounds, not shown on the plate, lying west of those represented. They consist of two ridges, one of considerable length, on the side of a ridge sloping towards the lake.

On the very high ledge of limestone, at the southwest corner of section twenty-seven, which overlooks Lake Horicon, I was disappointed in not finding artificial works.

On section twenty-five, township eleven, range sixteen, about seven miles south of Mayville, is a cross examined by Mr. S. E. Lefferts, of that place. We did not visit this locality, though we learned that the cross is associated with other mounds.

At the town of Theresa, on the elevated ground on the south side of the river, near the residence of Solomon Juneau, Esq., is a group of figures mostly of the lizard or oblong forms, and among them an excavation similar to those observed at Fort Atkinson and near Milwaukee (see Plate IX, Fig. 5). Most of the lizard mounds here are directed towards the south, but two are in an opposite direction; this being the first case of the kind observed.

A few Indians (Menomonees and Winnebagos) still reside here, and their wigwams are associated with the more substantial buildings of the white man. One of the oblong elevations was entirely covered with graves recently made by them.

I have heard of other works twelve miles east of Theresa, and at Mound Prairie, eight miles north; also about a mile and a half below Waupun, north of Horicon lake.

CHAPTER IV.

ANCIENT WORKS IN THE BASIN OF THE NEENAH, OR FOX RIVER OF GREEN BAY.

This important river rises in Columbia and Adams counties, in two small streams that unite a few miles north of Fort Winnebago. Thence it has a sluggish current and crooked course, expanding into broad shallow lakes, or winding through rice marshes, until it enters Lake Winnebago. At a place known as Butte des Morts (or Mound of the Dead), it receives the waters of Wolf river, which is larger than the Neenah itself. Between Lake Winnebago and Green bay the river has a descent, over numerous rapids, of one hundred and seventy feet.

The public surveys not having all been completed, the area drained by this river cannot be exactly stated; but it is estimated at about 6,700 square miles.

At a place on the east side of Green bay, called the Red Banks (township twenty-five, range twenty-two), as we are informed by Hon. Morgan L. Martin, in his annual discourse before the State Historical Society of Wisconsin, delivered in 1851, there are traces of ancient cultivation, still distinct, over a tract of several hundred acres, now overgrown with forest-trees of a large size; the product, according to computation, of five centuries. The remains of an embankment inclosing an acre or two of ground, occupy an elevated position in the immediate vicinity.

No other aboriginal works about Green bay have come to my knowledge, though they may have existed and been long since destroyed; for settlements have existed there since a period nearly or quite as far back as the year 1665.

Fig. 25.

Little Butte des Morts, as seen across the Lake. June 14, 1851.

Nor do we find such traces along the rapids below Lake Winnebago. The advantages of water power had no attraction for the natives. The gently flowing stream and placid lake were more favorite places of resort. Hence, we perceive no indications of ancient mounds till near Lake Winnebago; the first one in ascending the river being on the west side of Little Lake Butte des Morts, a name indicating the existence of the mound, and the purpose for which it was erected. (See Fig. 25.)

This tumulus is about eight feet high, and fifty feet in diameter. It is to be hoped that a monument so conspicuous, and so beautifully situated, may be for ever preserved as a memento of the past. It is a picturesque and striking object in passing along this fine lake, and may have been the cause of serious reflections and high resolves to many a passing savage. It is well calculated to affect not less the bosoms of more enlightened men. There is neither necessity nor excuse for its destruction; and we cannot but again express the hope that it will be preserved for the benefit of all who may pass along that celebrated stream.

The summit of the mound is about fifty feet above the lake, affording a very pleasing view embracing the lake and the entrance to the north channel of the river.

Among the articles discovered in the field near by, was some burnt clay in irregular fragments, with impressions of the leaves and stems of grass, precisely like those found at Aztalan.

This had been a place of burial, and, perhaps, of well contested battles; for the plough constantly turns up fragments of human bones and teeth, much broken and decayed. Arrow-points of flint, and pipes of the red pipestone and other materials, have also been brought to light.

Two miles further east, and half a mile from Menasha, is a group of eight mounds about four feet high, and from forty to fifty feet in diameter. They are on the southeast quarter of section fourteen, township twenty, range seventeen, not far from the shore of Lake Winnebago. This ground has been selected for a cemetery by the present inhabitants, who do not scruple to dig up the Indian skeletons to make room for the bodies of a more civilized race.

The ground here, as in numerous other places, exhibits marks of former culture in rows or beds, very different from that of the modern Indians. These are covered with a dense forest of young and thrifty trees, the largest not more, perhaps, than one hundred and fifty years old; so that the whole have grown up since the time of Marquette, or within one hundred and eighty years.

In the village of Menasha is an elongated mound, quite high at the end towards the river, and terminating at a point at the other. A similar one exists on Doty's island,[1] forming a sort of counterpart to the first. They are not exactly opposite, but are both directed towards the river.

The eastern extremity of Doty's island has long been occupied by Indians, as is evinced by the regular cornhills covering nearly the whole surface, as well as by a new feature, not before observed, or supposed to be within the pale of Indian customs. The ground was originally covered with loose stones, fragments of the solid limestone rock that exists everywhere not far beneath the surface. These stones had been carefully collected into little heaps and ridges, to make room for the culture of the native crops. The stone heaps are six or eight feet in diameter, and from one to two feet in height. The interstices are now filled with soil, and partially covered with grass and weeds.

The country about Lake Winnebago was first inhabited by the Kickapoo tribe;

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[1] The residence of Hon. James D. Doty, M. C.

though it is stated that the Mascontins (*Gens des Prairies*) were there at one time.[1] The former were driven away by the wandering and warlike tribes of Sauks and Foxes, who very early united, and, penetrating to the west, first established themselves here. They were in turn compelled to move further west by the Chippewas, aided by the French.[2] How long the Chippewas maintained possession is not known. In 1766, Carver found on Doty's island, "a great town of the Winnebagoes;"[3] and more recently this region has been occupied by the Menomonees.

Which of these tribes, if either, performed the labor of gathering up the stones, it would be difficult to decide; nor are we able to say whether the heaps are of the same age as the mounds or of later origin.

From Menasha we went in a sail-boat across the north end of Lake Winnebago, to examine and survey the mounds on the top of a high limestone cliff or ledge.

On the northwest quarter of section thirty-six is a small clearing on the bank of the lake, not far from the foot of the bluff, in which were traces of three long mounds; and in the adjacent forest are three small embankments, extending across a small ridge from the bank of the lake to a valley back of it. We had much difficulty in climbing the ledge, which has quite a formidable aspect, and is probably two hundred feet high above the water; the last forty or fifty being perpendicular, or nearly so. From the top commences an almost level plateau, extending towards the east; and here we were fully paid for our labor, by the magnificent view of the lake and surrounding country. Those who have examined the banks of the Niagara below the great falls, or the mountain ridge as is seen in western New York and Canada, will have a correct idea of this ledge of limestone; and being composed of a rock of the same geological age, the resemblance is not to be wondered at.

Passing along the ridge, we came upon the series of ancient works represented upon Plate XLI, No. 1,[4] extending for some distance near the edge of the rocky escarpment. It will be observed that they are of the same forms as those heretofore described further south and southwest, and, with one or two exceptions, are arranged with the heads towards the south.

The fact that the first figure is placed transversely, preceded by two mounds or advanced posts, may have a particular significance; but, if so, its meaning is now lost. The cross, near the centre of the group, is usually called "the man" by the few persons who have seen this locality; but it wants the legs and the contraction for the neck, seen in the mounds of human form at the West.

These are the most northern of any animal-shaped mounds in the eastern part of Wisconsin. They terminate near the south line of section thirty-six, township twenty, range eighteen.

Although tormented by mosquitos, and oppressed by the close, hot, and damp atmosphere of the dense forest, we followed the ledge five miles to another series of similar remains, represented on the same plate, No. 2.

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[1] Drake's Life of Black Hawk, p. 16.

[2] Supposed to have been in 1706.

[3] Carver's Travels, &c., N. Y. ed. 1838, p. 41.

[4] On this plate the figures are brought nearer together than the scale requires; but the distances thus encroached upon are given on the plate.

They are situated on the extremity of a ridge, at a place where the main ledge is further back from the lake, and is much less steep.

Here was found a turtle-mound, but differing from the usual form in several particulars, as will be seen by the figure.

The land along the east shore of Lake Winnebago is among the finest in the State. The growth of trees and shrubs is so dense that it is difficult to penetrate it without the aid of an axeman. It is just such land as would be selected by an agricultural people.

These are, doubtless, the structures alluded to by Mr. R. C. Taylor, from information communicated to him by Dr. Lyman Foote, of the United States Army.[1]

There are mounds of ordinary circular form in the vicinity of the southern extremity of Lake Winnebago; some of them have been opened and found to contain human bones.

We have heard of others of imitative forms on the west side of the lake, between Oshkosh and Fond du Lac, which we did not visit, nor could we obtain very definite information in regard to them.

Just before the Neenah enters Lake Winnebago, it expands into a broad sheet of water called the Great Butte des Morts lake. Near the head of this lake is the mound from which its name is derived, on the north or left bank of the river. This is the site of the conflict between the Chippewas and French against the Sauk and Fox bands;[2] but I can find no authority for the popular belief that the tumulus was raised at that time as a covering for the bodies of the slain.

Near this Butte the Wolf branch of the Neenah enters, being properly the main stream. Col. Charles Whittlesey, of the United States Geological Corps, explored this stream, and he informs me that he found no remains of ancient works on its banks.

At the Falls of the Waupacca (a tributary of the Wolf) mounds are said to exist, and also at some other localities in the vicinity.

Near a small stream, called Eight-mile creek, in the town of Utica, on the land of Mr. E. B. Fiske (northwest quarter of section fourteen, township seventeen, range fifteen), is a mound called the Spread Eagle (see Plate XLI, No. 3). It is of small dimensions, the whole length being only forty-six feet.

There are two oblong embankments in the vicinity; and the house is built upon another called the Alligator, but its form could not be distinctly traced at the time of our visit.

There is a group of conical tumuli, forming an irregular row, half a mile below Ceresco (section seventeen, township sixteen, range fourteen), and others of a similar character formerly existed at and near the village.

At several points along the Neenah, between the Portage at Fort Winnebago and the Butte des Morts, are localities of mounds.

Mr. R. C. Taylor informs us that "on the shores of Buffalo and Apuchwa lakes, wherever the land is dry and sufficiently elevated, one may observe, even from the

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[1] Silliman's Journal, XXXIV, 95.

[2] Pike's Expedition, Appendix to Part I, p. 45.

water, a vast number of tumuli. Upon the summit of some of these may, from time to time, be recognized the modern grave of some Winnebago or Menomonee chief, strongly protected by pickets. The margins of the Neenah river are remarkable for numerous Indian remains of this description. Colonel Petitval, of the United States Topographical Department, who was engaged during the summer of 1837 in a survey of this river, had the kindness, at my request, to give some attention to these mounds. He describes an immense assemblage of them at a point on the river called the Red Bank, extending far into the interior, both north and south, for an undetermined distance. Twelve of them at this place were opened under his direction, and among them was an animal mound one hundred and fifty feet long. All contained human bones in a very decomposed state."[1]

The mounds examined by me along the Apuchwa and Buffalo lakes, were entirely of the conical form, or burial-mounds. They were observed at the villages of Marquette, Montello, Roxo, and Packwaukee; the same places that formerly were the seats of aboriginal population being now selected as the sites of embryo towns and villages by men of a different race.

There is a fine group on section twelve, township fourteen, range ten, occupying prairie ground near a branch of Grand river. Further up this river (on section eleven, township fourteen, range eleven) is a collection of about one hundred mounds, mostly of the same form. Only one was sufficiently perfect to admit of being surveyed and delineated. It is called the "Man," and is remarkable for the unequal length of the arms. (Fig. 26.) It had been opened before our visit. The

Fig. 26.

The Man, near Mt. Moriah.

head points to the south, and towards a high hill called Mount Moriah. The soil is sandy, and the mounds do not, therefore, preserve their original shape as distinctly as in other localities. The round mounds are worn down and spread out, so as to form

[1] Silliman's Journal, XXXIV, 95.

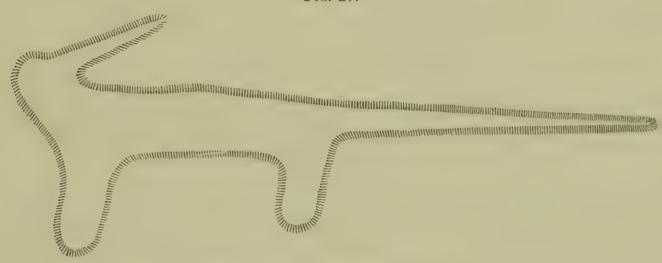
a very flat cone. In one was found the skeleton of a man, with fragments of pottery, &c.

There are also a few mounds near Lake Maria, at the source of Grand river (sections twenty-five and thirty-six, township fourteen, range twelve).

The Neenah river is in some places bordered by a high sandy bank, frequently higher near the water than further back. Along the margin of this bank, small indistinct mounds are of frequent occurrence, placed as if intended to guard or watch the passage of the river. They are often of a subtriangular form, the shortest side and highest point being towards the river. They are unusually small, and have but little elevation.

At a place known as Moundville, are some structures quite perfect in their shape and outline. They are in the oak-openings, on the west side of the river, in township fourteen, range nine; and consist of several raccoons and bears, with oblong and round mounds, and one animal form (Fig. 27), whose genus and species could not well be made out.

Fig. 27.



At Moundville. Forty feet to an inch.

CHAPTER V.

ANCIENT WORKS IN THE BASIN OF THE WISCONSIN RIVER.

The Wisconsin river is the largest stream within the State, having its source on the boundary line between Wisconsin and Michigan, in a small sheet of water known as "Lac Vieux Désert," and running into the Mississippi at Prairie du Chien. Its general course is nearly south as far as the Winnebago portage, where it almost unites with the Neenah. At this point it is suddenly deflected towards the southwest and west. Its length cannot be less than four hundred miles, and it has an aggregate descent of about nine hundred feet, or two and a quarter feet per mile. It drains an area of about eleven hundred square miles.

The valley of this fine stream, from the Winnebago Portage to its junction with the Mississippi, may be deemed the great central seat of population at the time of the erection of the animal-shaped earthworks; at least we must so infer from their comparative abundance and importance along that valley.

The first published notice of the mounds in the valley of the Wisconsin, is in the narrative of Long's Second Expedition, in 1823. It is there stated that "one of the block-houses of the fort (at Prairie du Chien) is situated on a large mound, which appears to be artificial. It was excavated; but we have not heard that any bones or other remains were found in it."

Mr. Alfred Bronson, in a paper on the ancient mounds of Crawford county, Wisconsin, read before the State Historical Society, remarks that another similar one formerly existed on the prairie, now removed; but no evidences of the design of their erection were found—nothing was observed but bones, rifles, &c., of recent interment.

"One mound, standing in a group at the southwest angle of this prairie, has a base of some fifty feet, and is about ten feet high, on an eminence of about the same elevation. From its top can be seen to advantage the extensive low bottom-lands which lie between the Wisconsin and Mississippi rivers; and were it not for the timber on the margin of the two rivers, their flowing currents could also be seen for some distance. This circumstance induces the belief that it was built for a kind of watch-tower, or look-out place, to watch the approach of enemies."

Traces of mounds were discovered by me (in 1852) along the whole extent of the prairie, apparently similar to others found in the vicinity; but from cultivation, and the light sandy nature of the materials, they are now almost entirely obliterated. The large round tumuli, situated along the island between the "slough" and the main channel of the Mississippi, are so near the level of the river that their bases are often washed by the floods. In 1826, at the highest known floods,

(it being eight feet higher than the high water of 1832, and about twenty-six feet above the lowest stage,) the mounds were all that could be seen of this island above the water. These were doubtless for burial, and of less age than the more elaborate works in the interior of the country.

Below the town and fort, towards the mouth of the Wisconsin, are similar tumuli, equally subject to overflow; and on the high bluffs south of that river are some look-out stations or mounds.

Advantage is taken of these elevations for the foundations of the better class of dwelling-houses, above the reach of high water; being, perhaps, the only instance in which the ancient works are rendered useful to the present inhabitants. In general it is deemed necessary to remove them as incumbrances, rather than to preserve them as matters of convenience.

Some traces of a ditch and embankment observed on the island, evidently of a military character, proved, on inquiry, to be the remains of the original American fort, that was taken by the British in the war of 1812.

It is quite clear that this interesting place has been a favorite one with all the different tribes or races of inhabitants, from the days of the first mound-builders to the present time; and the construction of a railroad (soon to be completed) connecting this point with Lake Michigan at Milwaukee, will doubtless render it one of the greatest importance.

Proceeding up the Wisconsin, the first locality requiring notice is called by the French the *Petit Cap au Grés;* which was visited by Messrs. Keating, Say, and Seymour, of Long's exploring party, and of which the following account is given: "They found the bluff which borders on the Wisconsin, about four miles above its mouth, covered with mounds, parapets, &c.; but no plan or system could be observed among them, neither could they trace any such thing as a regular inclosure. Among these works, they saw an embankment about eighty-five yards long, divided towards its middle by a sort of gateway about four yards wide. This parapet was elevated from three to four feet; it stood very near to the edge of the bluff, as did also almost all the other embankments which they saw. No connection whatever was observed between the parapets and the mounds, except in one case, where a parapet was cut off by a sort of gateway, and a mound placed in front of it. In one instance the works, or parapet, seemed to form a cross, of which three parts could be distinctly traced; but these were short: this was upon a projecting point of the highland. The mounds which the party observed, were scattered without any apparent symmetry over the whole of the ridge of highland which borders upon the river. They were very numerous, and generally from six to eight feet high, and from eight to twelve in diameter. In one case a number of them, amounting perhaps to twelve or fifteen, were seen all arranged in one line, parallel to the edge of the bluff, but at some distance from it."

The very numerous and highly interesting remains found on the banks of the Wisconsin at Muscoda, and in its vicinity, are very fully described and delineated by Mr. Stephen Taylor, to whose paper in Silliman's Journal (XLIV, 22), and in the abstract of it in the Smithsonian Contributions (I, 128–133, Plates xlii, xliii, xliv), the reader is referred. Not having visited this locality, I have nothing to add to the ample details given by Mr. Taylor.

My investigations in the vicinity of the Wisconsin embraced Prairie du Chien, and extended about thirty miles on the north side of the river, commencing at Helena, the site of the oft described Shot-Tower. Two miles above this place (on section eight, township eight, range four, E) are some mounds; but the first of much note as we ascend the river, along the road on the north side, are those on section four of the same town (see Plate XLII, No. 1), consisting of a series of oblong and conical tumuli, with one apparently leading the flight, in the form of a bird with outspread wings. These are composed of sand; and in some cases, where the road has been removed or destroyed, the wind in dry weather is fast reducing them to a level. The bird, of which an enlarged plan is given on the plate (Plate XLII, No. 2), is of the same material; and we found it very difficult to trace the exact original outline, from this cause. It *may* be regarded as representing a barbed spear-head or arrow-point. Were we to confine our attention to one or two of the oblong mounds on the edge of the bank, we might be led to regard them as breastworks, or parapets, for defence, and perhaps to command the channel of the river; but an inspection of the whole group shows clearly that no such purpose could have been intended.

They occupy a sandy plain, bounded by the channel of the river, or bayou, on one side, and by the bluffs on the other. The ground is covered with scattered trees, and an undergrowth of grass and weeds; but few shrubs being present.

About a mile and a half beyond, on the side of the road, is the human figure with its gigantic arms, having a stretch or extension of two hundred and eighty-eight feet (see Plate XLII, No. 3); so great, indeed, that the size of the plate adopted requires the omission of part of one of them. They are both of the same length. The body is fifty-four feet long, if we include the head and neck.

This figure stands by itself, in a valley or pass between two of the high sandstone bluffs, one of which rises immediately above the head. A small brook, a tributary of the Wisconsin, runs a little to the east and south.

From the site of this remarkable and lonely structure, the road leaves the immediate valley of the Wisconsin, and, passing a "divide," descends into the valley of the stream called Honey creek. Towards the mouth of this creek are numerous works of great interest; the first, near the residence of Mr. Mosely, being represented on Plate XLIII. Unluckily the breaking-up team had, only the week previous to our visit, turned over the natural sod upon most of these works; the four figures at the southwestern part of the group only remaining uninjured. Here we found a number of forms quite different from any heretofore described. One is apparently intended to represent the human shape, though very deficient in the proportional length of the arms and legs. (See Plate XLII, No. 4.)

Another, and larger mound, of similar general form, stands adjacent; and it can hardly be supposed that the object of the one was very different from that of the other. Perhaps they are designed to represent a male and female.

These earthworks are four feet high at the intersection of the arms, where they are highest. The arms are in a straight line, at right angles with the body. The resemblance of the latter figure, however, to some supposed to be intended to represent *birds*, shows that there is a gradual transition from one form to another among mounds of this kind as well as others.

The two figures adjoining these, are presumed to represent the buffalo or bison (*Bos americana*). One of them was carefully measured, and the result is shown in the enlarged figure (Plate XLV, No. 1). The general contour, especially the hump over the shoulders, renders the suggestion probable. The forms are almost exactly alike, though one is slightly larger than the other. They also may be intended for the two sexes. It will be observed that the attitude is quite spirited and natural; probably representing the animals in the act of browsing or drinking.

The two quadrupeds north of the road, were too much injured by the plough to enable us to make them out satisfactorily; but they did not appear to present any new features. The long ridges (nearly a thousand feet in length) are a peculiar circumstance in this group; yet they seem to be located without design. The one with an irregular cross ridge near the top may be thought to represent a bow and arrow; or it is a cross with curved arms.

These works occupy a gentle slope, extending from the base of the high bluffs towards the marshy and springy grounds at the south. Beyond the marsh another bluff rises abruptly. The space between the bluffs only is used for agricultural purposes; and, if in possession of a warlike people, we might fancy these long ridges constructed to defend the passage leading between the bluffs, from the valley of the river below, to the interior or back country. This may have been the object of the most easterly and longest ridge or parapet; but of what use, according to this theory, were the other similar ridges, which could not have been intended for defence?

It is much to be hoped that the proprietor of the two buffalo effigies will not allow them to be wantonly destroyed. They escaped the first efforts of the plough; it will be fortunate if they always secure the same exemption.

As it is frequently important to know the relative situation of various groups of works, in order to determine their dependence, if there be any, one upon another, I have given a map (Plate XLIV, No. 1), showing the position of this group in respect to two others next to be noticed. Half a mile south of the space covered by this map is the Wisconsin river. The bluffs here leave the river, and extend along the west side of Otter creek; the broad plain known as Prairie du Sac, or Sauk Prairie, lying between them and the river. It will be observed that the group just described occupies one of the *passes* by which the road ascends the bluffs.

The works near the centre of section seven (Plate XLIV, No. 1), are on the margin of the marsh which borders the creek. Here are several oblong mounds, one of the bird form, and two anomalous images, of which drawings are given (Plate XLV, Nos. 2 and 3). Though they are evidently animal forms, it would be difficult for the most practised zoölogist to determine the genera and species to which they should be referred. These are on ground gently sloping from the bluffs in the rear to the edge of the marsh, where there is a bank of no very great elevation.

On the east side of the creek, at the middle, commences a series of earthworks of a very interesting character, as shown on Plate XLIV, No. 2. The principal figure, in the form of a bird with a forked tail, is also represented enlarged on Plate XLVI, No. 3.

The bear is enlarged, and shown with its true proportions, on Plate XLV, No. 4.

It can hardly admit of a doubt that this animal is intended, if we judge from the general form of the image.

One of these figures had apparently been cut in two by some cause since it was completed. Several excavations made in building the dam have injured or destroyed some of these works. We noticed here that the reddish earth excavated from the pits very soon lost its redness on exposure to the air, and assumed the light color of the earth found in the animal mounds. This will explain the difference in hue without resorting to the improbable suggestion that the soil has been brought from a distance. The birds and bear are on the margin of the beautiful level plain, here mostly covered with trees; a part of the great plain or prairie before alluded to.

It is to be observed, that the difference between the mounds evidently birds (Plate XLVI, No. 3) and those resembling the human form (Plate XLII, Nos. 3 and 4), is but slight; so that, strange as it may appear, it is sometimes not easy to decide which was meant by the ancient artist.

The prairie along the river, above Honey creek, gives evidence of recent Indian occupancy in the numerous irregular corn-hills, such as are now made by them. In 1766,[1] and probably for a long time afterwards, it was the site of a village of the united Sauk and Fox tribes—hence, the name of the prairie. But few remains of the labors of the "ancient people," however, were observed on this plain, until we approached its upper margin. Here we found, near the residence of Mr. Charles Durr, several parallel ridges, and a few imitative forms. One of these, with the anterior foot remarkably enlarged, is represented on Plate XLVI, No. 1. These works are near the line between sections seven and eight, township ten, range seven east.

We here found a number of ridges with an angular deflection near the smaller extremity. (See Plate XLVI, No. 2.) They have about the usual height of oblong parapets and ridges, from two to four feet, and vary in length from two hundred to several hundred feet. They differ from the crooked ridge (Plate XLIII), on Honey creek, in having the deflected portion straight.

We noticed here a mound with a horn, apparently intended to represent the elk or deer; which, as night overtook us, we did not survey.

A short distance above commences a series of works surveyed by Mr. William H. Canfield, of Baraboo, and represented on Plate XLVI, No. 4, and on Plates XLVII and XLVIII. They are located on the slope extending from the bluffs to the river, here about two miles apart. The ground is not level or even, but gently rolling, and the principal mounds are handsomely situated on the knolls. The little brook on Plate XLVII is usually dry, and runs in a valley but slightly depressed below the general surface. Towards its source the ground is more level and a little marshy. The bed of the stream is a little gravelly.

The sharp-pointed ridges, some straight, and others with an angle near the extremity, and the animal with several humps on its back, are peculiar features in this group.

The works represented on Plate XLVIII are about a mile north of the last, and

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[1] Carver's Travels (Harper's N. Y. Ed., 1838), p. 49.

about midway between the bluffs and the river. The pond contains pure water, and now supplies the inhabitants of a very different race with this indispensable element.

About two miles further up the river (on section three, township ten, range seven east), is another group, of which only one figure was surveyed by Mr. Canfield (Plate XLVI, No. 4). The form of the head and wings leaves no doubt that the object intended was a bird.

As this bird is represented in the act of flying, the remark of Mr. Canfield that it may be a messenger-bird carrying something, indicated by the little mound placed below the wing, as if suspended from its beak, seems quite probable. This mound is small (seven feet in diameter), a very true circle at the base, and now less than a foot in height. Perhaps the purpose is to represent the bird as bearing to the spirit-land some person whose remains were deposited in the mound.

Mr. Canfield writes that "the valley of the Wisconsin river above Prairie du Sac, for three or four miles, is completely filled with these works. It is here two miles wide, timbered mostly with black and burr oak, generally of a light sandy soil, and quite undulating, in some places hilly. There are no mounds on the prairie."

There are scattered tumuli of various forms in and about the village of Baraboo, on the river of the same name.

A little east of that remarkable gorge in the sandstone, known as "the Dells of the Wisconsin river," is a small inclosure (Fig. 28), of double walls, which may

FIG. 28.

Ancient inclosure, Dells of Wisconsin river.

have been surmounted by palisades, and have formed a sort of fort or stronghold. The breadth occupied by the two embankments is eighteen feet, and the area of the inclosure is about 45,000 square feet, affording room for about 2,000 persons.

There are also some other slight works in this vicinity, mostly oblong mounds, called breastworks by gentlemen of military associations; and there are extensive tracts of ground worked into garden-beds, or low flat ridges, as before described.

There are also some mounds at the foot of the Big Dells, six miles further up the river.

Following up the valley of the Lemonwier river, a branch of the Wisconsin from the west, the first group of works observed was near One Mile creek (section twenty, township fifteen, range four, delineated on Plate XLIX). There are six embankments of different lengths, three bird-shaped mounds with large bodies, and two small oval tumuli, all arranged on or between two sandy ridges that very much resemble ancient lake beaches. The works are arranged in a direction parallel to these two ridges; and the wings of two of the birds extend entirely across the low ground between them. On both sides of the ridges the ground descends into low marshy places of considerable extent.

The two oblong embankments situated upon the sand ridge might be supposed to be works of defence, or breastworks; but as they are of precisely the same character as the others whose position between the ridges precludes such an inference, we must, as in other cases, conclude that they were constructed for a different purpose. The ground is here occupied by the oak-openings, or a scattered growth of trees. The marshes on each side may formerly have been ponds, now filled by the accumulation for ages of vegetable matter.

At Mors creek (section seven, township fifteen, range four, east), there is a series of mounds, as delineated on Plate L. They extend along the river at intervals for two miles. The group near the mill (Plate L, No. 1), is much injured by a removal of the earth to form the dam across the Lemonwier river. It consists, as will be seen, of bird-shaped and oblong earthworks. No. 2 of the same plate is an enlarged plan of the two most perfect of these images. Upon excavating one of them, the remains of a human skeleton were found, which had been deposited in the head of the figure. These mounds are here supposed to represent men. They are upon a gentle slope or nearly level space between the river and the foot of a ridge, or second bank, which is but slightly elevated above the water of the river. Several round tumuli are found on the ridge a few rods further west.

On Plate L, No. 3, is represented a very long-armed figure, situated near Two Mile creek (about two miles above Moss's Mill), where are others quite similar to those exhibited on the same plate, No. 2. These long arms extend quite across from the abrupt bank of the river to some marshy grounds.

In the same neighborhood is said to be a small circular inclosure (southwest quarter of section twenty-one, township sixteen, range three), and also (on the northwest quarter of section twelve, township fifteen, range three) a series of garden-beds.

Leaving the main Lemonwier river, we passed between two isolated sandstone cliffs, known as the Little Bluffs (section twelve, township sixteen, range two, east), and observed two oblong embankments, or breastworks; but they did not appear to be arranged with any purpose of defending the narrow pass between the bluffs.

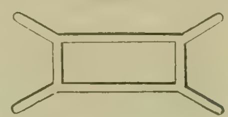
On section nine, township sixteen, range two, east, we found an oblong embankment; and also one called a man, with the legs expanded, but having no contraction for the neck. (See Plate L, No. 4.)

Several earthworks (one of the man shape) are found on section five, township sixteen, range two, east; and a row of five oblong elevations, with but slight intervals, occupy a swell in the prairie on section four, township sixteen, range one, east.

Above these we discovered no more mounds on the Little Lemonwier. The country becomes more hilly; the valley is narrow, and the stream small; affording no suitable position for an aboriginal population.

Above the mouth of the Lemonwier, on the Wisconsin, I have no information of ancient works, except a few mounds at Du Bays, at Plover Portage, and an inclosure recently discovered and described to me by Mr. Erskine Stanbury. It is spoken of as "a fort" in township twenty-one, and range seven, east, on the line between sections nineteen and twenty, seven hundred and thirty chains from the south corner of those sections. It is on the bold bluff bank of what we call Iron creek. It consists of an oblong or parallelogram, its longer axis with the direction of the stream. The walls are about the usual height, with a regular ditch or fosse all round them; and in the ditch and fort, trees from six to ten inches in diameter are now growing. From each corner a straight mound is thrown up, running off to some distance, as in the figure. The ground was covered with snow, or we would have taken a survey and measurement.

Fig. 29.



Fort at Iron creek.

ANCIENT WORKS AT LAKE VIEUX DESERT.

In the second volume of the History of the Indian Tribes (p. 91, Plate lii), just published by authority of Congress, is a plate representing the ancient works situated on one of the three islands in Lake Vieux Désert, the head of the Wisconsin river, accompanied by the following brief notice:

"The remote position of Lake Vieux Désert, its giving rise to the Wisconsin river, and its having a large island in its centre which fits it for the cultivation practised by the Indians, appear to have early pointed it out as a retreat and stronghold of the interior Indians. No enemy could approach it except by water, and its natural capacities for defence were strengthened by an elliptical embankment in its centre, which appears to have served as the basis of pickets. There were small mounds or barrows within the inclosure, together with some cross embankments, and two large excavations without the embankment, all which are shown in the plate. It appears to have been the most northwesterly point fortified, east of the Mississippi river. The boundary which separates Wisconsin from Michigan cuts the island into nearly equal parts."

It is not stated when or by whom these works were surveyed. The general parallelism of the embankments with the shore of the island, and the occurrence of large pebbles in their materials, lead to the suspicion that they may be natural ridges, caused by the expansive force of ice. Such ridges are quite numerous along the banks of the smaller lakes in this climate.

CHAPTER VI.

ANCIENT WORKS AND ANCIENT MINING, AT LAKE SUPERIOR AND MISCELLANEOUS LOCALITIES.

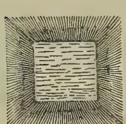
In the geological report of Messrs. Foster and Whitney, made to Congress in 1850, we have some details of discoveries of traces of ancient mining in the copper district south of Lake Superior, and also on Isle Royale. They "consist of numerous excavations in the solid rock; heaps of rubble and earth along the courses of the veins; the remains of copper utensils, fashioned into the form of knives and chisels; stone hammers, some of which are of immense size and weight; wooden bowls for bailing water from the mines; and numerous levers of wood used in raising the masses of copper to the surface."

Traces of mounds, constructed in the form of mathematical figures, were observed. One on the northeast quarter of section sixteen, township fifty, range thirty-nine, near a small stream, is about ten feet high, in the form of a square, flat on the top, the sides of which are fifteen feet in length. The slopes are regular from the top to the base.

From this description, and the drawing accompanying it (Fig. 30), this tumulus appears to be a regular pyramidal structure, like those within the walls of Aztalan, the temple-mounds so often found in the Southern States, and the teocalli of Mexico. We might draw the conclusion that people having the same form of worship were spread over this whole extent of country, and that those who had gone to the remote regions of Lake Superior had so much respect for their religion as to erect a small altar or temple-mound, to answer their temporary purposes while engaged in the duty of supplying the nation with copper.

The stone hammers (Fig. 31), observed in great abundance about these mines,

Fig. 30.



Temple Mound, L. Superior.

Fig. 31.

Stone Hammer of Ancient Miners.

Fig. 32.

Stone Axe, L. Superior.

show that the process of cutting the masses of native copper was practised then as it is now, only with tools of different materials. These seem to have been manu-

factured on the ground, and differ from the articles of stone obtained from the mounds further south.

Among them, however, are stone axes (Fig. 32), quite similar (if we may judge from the delineation of Messrs. Foster and Whitney) to those common to the whole country; and they form another connecting link between the mound-builders and the ancient workers of the Lake Superior copper mines.

Dr. C. T. Jackson attributes these operations to the Chippewas; implying that the ancestors of the present race of Indians made the excavations, stone hammers, axes, &c.

If we assume the age of the tree found growing upon the rubbish thrown out of an ancient mine (three hundred and ninety-five years) as indicative of the epoch, or near it, when the mines were worked, it is only about double the time that the Chippewas have been known to occupy this region. The discovery of wooden levers and wooden bowls, forbid us to assign a much greater antiquity to these works. If these Indians have remained unchanged in their general habits for a period of two hundred years, it requires no aid from the imagination to suppose that they had then occupied the same country for one or more terms of equal duration; and there is, therefore, nothing improbable in the supposition that Wisconsin was occupied by the present race of Indians (if not of the same nations or tribes), five or eight hundred years ago.

The existence of wood buried in mounds at Aztalan, and other places, not entirely decayed, and the condition of the bones and other articles accompanying it, show conclusively that they could not have been deposited for a much longer period than that mentioned.

When the country about Lake Superior was first visited by French missionaries, about the middle of the seventeenth century, or two hundred years ago, copper was used by the Chippewas.

Alloüer writes (in 1666), "It frequently happens that pieces of copper are found weighing from ten to twenty pounds. I have seen several such pieces in the hands of savages; and since they are superstitious, they esteem them as divinities, or as presents given to them to promote their happiness by the gods who dwell beneath the water. For this reason they preserve these pieces of copper wrapped up with their most precious articles. In some families they have been kept for more than fifty years; in others they have descended from time out of mind, being cherished as domestic gods."[1]

Father Dublon (1669–70) says, in relation to the copper, that the Indians were shy of disclosing their knowledge of it, "so that we were obliged to use some artifice."[2]

If, then, these fragments of copper were held so sacred as to be kept and handed down as household gods, we may certainly allow some lapse of time for such superstitions to originate and become incorporated into the religious system of the

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[1] Quoted by Foster and Whitney, page 7.

[2] Same, p. 10.

Chippewas; and a comparatively slight draft upon the past, anterior to that period, will carry them back to the age of the ancient mining and mound-building.

Upon a general consideration of these investigations, we are led to the inference that the men who built the earthworks of Wisconsin, and those who first opened the Lake Superior copper mines, were one and the same people, and that they were none other than the ancestors of the present race of Indians. Differences there may have been, as we now see in tribes residing within a few hundred miles of each other; but these differences were perhaps no greater at that remote period than at present.

But to account for the presence of copper among the mound-builders, we need not resort to Lake Superior. Fragments of this metal in its pure or native condition, are very often found associated with the "drift," which has doubtless been transported from the same region of country. Such fragments are frequently washed from the banks by rains, or by the action of the waves on the margin of the lakes. Since the settlement of the country they have often been turned up by the plough. They vary in size from the smallest fragment to twenty pounds or more in weight; and from this source probably all the copper used by the natives, other than that from mines, was derived. The chemical tests applied would not, of course, decide this question.

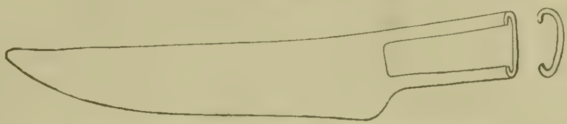
With regard to the ancient mines at Lake Superior, it might be questioned whether the old French missionaries and traders did not succeed in extorting from the Indians, by artifice, the secret of their locality, and then make abortive attempts to remove some of the large masses there found. In the report of Messrs. Foster and Whitney, before referred to, it is stated that Mr. Samuel O. Knapp (who first laid before the public an account of the nature and extent of the primitive mining) discovered "a mass of native copper ten feet long, three feet wide, and nearly two feet thick, and weighing over six tons. On digging around it, the mass was found to rest on billets of oak, supported by sleepers of the same material. This wood, by its long exposure to moisture, is dark colored, and has lost all its consistency. A knife-blade may be thrust into it as easily as into a peat bog. The earth was so packed around the copper as to give it a firm support. The ancient miners had evidently raised it about five feet, and then abandoned the work as too laborious. They had taken off every projecting point which was accessible, so that the exposed surface was smooth."

Again, "in cleaning out one of these pits, at the depth of ten feet, the workmen came across a fragment of a wooden bowl, which, from the splintery pieces of rock and gravel imbedded in its rim, must have been employed in bailing water."

Now, unless there is some mistake as to these facts, we are not disposed to attribute this work to the aboriginal inhabitants. The sleepers, levers, wooden bowls, &c., are rather indicative of Caucasian ingenuity and art. Nor do the copper knives of Lake Superior have the appearance of great antiquity. Their form indicates quite plainly the knife of the white man; although the method of attaching the handle by turning up the edges, may be of aboriginal origin. See Fig. 33, which is a half-size drawing of a copper knife from Lake Superior, presented to me by Mr.

O. Vandyke. Arrow-points were attached in the same way (see Fig. 34), as shown by one found at Menasha, on Lake Winnebago, and received from Mr. Curtis Reed.

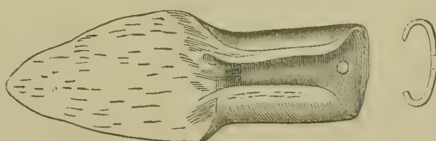
Fig. 33.



Copper Knife from Lake Superior. (One half natural size.)

In the immediate valley of the Mississippi the animal forms do not appear to be as numerous as on the Wisconsin and in some other localities. So far as I can learn, they extend down only as far as Apple river, in Illinois, a few miles south of the State line of Wisconsin.

Fig. 34.



Indian Arrow-head, of copper. Natural size.

There are occasional localities south of the Wisconsin river, where traces of ancient works can be seen; but the immediate bank of the Mississippi is so broken that it could not be explored without much labor and difficulty.

The works at Prairie du Chien, heretofore described (page 66), are the most extensive of any on the river; but these are too much injured to exhibit with distinctness their original forms.

Along the great dividing ridge between the Mississippi and the Kickapoo rivers, there are mounds in great numbers. Their general character is the same as that of those near the residence of Mr. Miller (Plate LI), and they may, without much effort of imagination, be classed among the birds and buffaloes, accompanied by oblong and circular mounds. This ridge may be aptly compared to the back-bone of some gigantic animal, the numerous lateral spurs, extending towards the Mississippi or the Kickapoo, representing the ribs.

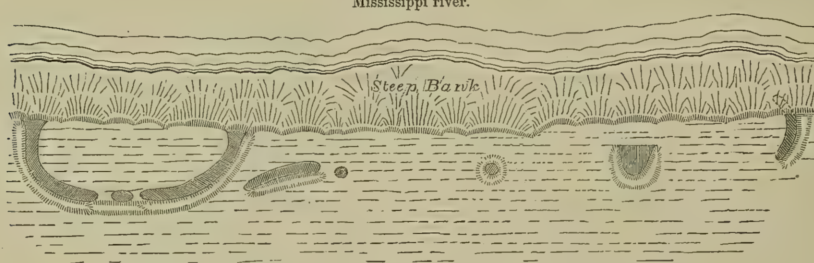
The animal effigies along the ridge are usually headed towards the south or southeast. The elevation is from four hundred to seven hundred feet above the adjoining rivers. The arrangement of the strata of rock (as exhibited in the section, Plate LI) is such as to cause numerous springs to gush out on either side, not far below the summit; and that circumstance may have led to the occupancy of the ridge by so large a population, as is indicated by their works still remaining. It is now inducing settlements in the same locality by a different race of men; the prime necessities of man being alike under all circumstances.

Isolated tumuli exist near the waters of the Mississippi along this part of its course; and at the place where the road turns off towards Springville, at Bartlett's Landing, is a very considerable assemblage, mostly of circular and oblong mounds, occupying the summit and sides of a narrow ridge. (Plate LII.) The river is here divided into several distinct channels, called "sloughs."

At La Crosse there is a prairie between the river and the bluffs, which has always been a favorite place of resort for the Indian. The conical tumuli forming a row parallel with the river, manifest also the residence of the mound-builders. The materials of these works being sand, they are now much reduced, and can be discovered only upon close inspection. I could find none that appeared to have had any animal or other imitative forms.

On the immediate brink of the river are excavations bordered by embankments. Some are circular, and resemble the remains of the Indian caches; while others are of a different form, as represented in Fig. 35. Several were observed in the shape

Fig. 35.



Ancient Works on the bank of the Mississippi, at La Crosse. Forty feet to an inch.

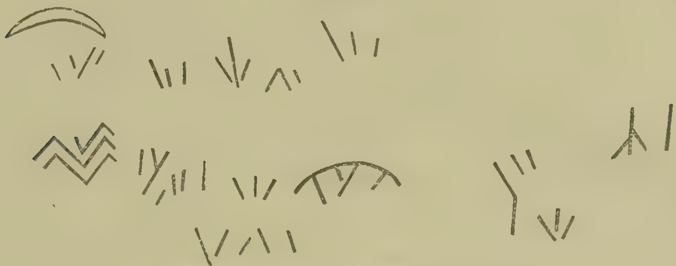
of a crescent, the excavation gradually deepening from the horns towards the centre. All have the elevated ridge on the side furthest from the river; so that if these works were intended for defence, it was against an enemy from the land. They are of no great extent; many of them would not protect more than two or three persons.

Perhaps it was to excavations of this kind that Lieutenant Pike alludes in his journal (page 19), where he says: "The Sioux have a mode of defence or secretion by digging holes in the prairie, and throwing up a bank around it, into which they put their women and children, and then crawl in themselves." The soft sandy nature of the ground here would easily admit of the employment of that kind of protection.

On the eastern border of this prairie are some very high bluffs, presenting towards the top perpendicular cliffs of limestone. On one of these, known as Gale's Bluff, we found a large crevice or cave, in which, among some loose stones and sand, were several human bones; and a skull has been taken from the same place. No bones of animals could be found. The rock above the cave is perpendicular for a great height.

On the south side of the entrance are some markings (Fig. 36), doubtless of aboriginal origin, and possibly intended to record the virtues of the person or per-

Fig. 36.



Indian Hieroglyphics, Gale's Bluff, near La Crosse.

sons whose remains are there deposited. The marks are on a soft, yellow, granular limestone; often mistaken by casual observers for sandstone. They are not deeply impressed, and have evidently been affected by the crumbling of the surface.

Only an occasional mound was observed along the valley of La Crosse river; and it is believed that no works of any considerable extent exist above this point on the Mississippi.

CHAPTER VII.

CONTENTS OF THE MOUNDS; REMAINS OF ANCIENT WORKMANSHIP.

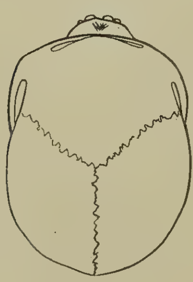
We have already stated, in their proper connection, the results of the examinations of the mounds at various places; but some general facts remain to be mentioned.

It is important to determine with certainty whether the relics found buried are the work of the original mound-builders, and placed there at the time of the erection of the mounds, or have been deposited subsequently. This can usually be done with a reasonable degree of certainty by one accustomed to such investigations.

So far as I have had opportunity to observe, there are no original remains in the mounds of imitative form, beyond a few scattered fragments that may have gained a place there by accident. Many of the mounds have been entirely removed, including the earth beneath for a considerable depth, in the process of grading streets in Milwaukee; and it is usually found that the natural surface had not been disturbed at the time of the erection, but that the several layers or strata of mould, clay, gravel, &c., are continuous below the structure as on the contiguous grounds.

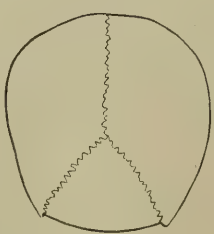
Great numbers of the smaller conical tumuli are also destitute of any remains; and if human bodies were ever buried under them, they are now so entirely "returned to dust" that no apparent traces of them are left. If we assume that each mound was a place of burial, we must infer from the absence of utensils that the common practice of depositing with the dead the implements to be used in the other

Fig. 37.



One-quarter size.

Fig. 38.



One-quarter size.

world, is of comparatively recent origin; since some of these, at least, would have resisted decay. The middle-sized conical mounds, and those of larger dimen-

sion, almost always contain evidence of the deposit of one or more human bodies. These are always very much decayed; only one skull having been found sufficiently entire to enable Dr. Hoy, with much skill and labor, to restore it sufficiently to make out its general characteristics. A fortunate combination of circumstances had caused this preservation. The skull and some other bones were enveloped in a peculiar kind of clay, which seems to have possessed a preservative quality beyond that of ordinary earth, of which most of the accumulation was composed; and on the very top of the mound was a large tree, which had shed off the rains for several centuries. Many peculiarities of this cranium are pointed out by Dr. Hoy. (Chapter I, page 9.)

On Plate LIII, there is a drawing of the natural size; and figures 37 and 38 represent the top and back views of the same skull reduced to one quarter of the natural size.

The following are its dimensions:

	Inches.
Longitudinal diameter	6.8
Parietal diameter	5.3
Occipito-frontal arch	13.8
Length of head and face	8.2
Zygomatic diameter	4.9
Facial angle	76

To give the reader more particular information respecting the supposed characteristics of this interesting relic of an extinct people, I have, with the assistance of a phrenological friend, prepared the following "chart." For the localities of the "organs," &c., reference was had to Spurzheim,[1] whose works have become a portion of the literature of the country, and are to be found in all important libraries. Although the principles of this professed *science* may not be true in all their details, yet its nomenclature affords the means of presenting the conformation of the skull in a definite manner. The figure following the name of each organ indicates its relative development; 0 signifying deficiency, and 6 very full or unusual prominence.

AFFECTIVE ORGANS.

I. Propensities.	
Destructiveness	4½
Amativeness	6
Philoprogenitiveness	6
Adhesiveness	5
Inhabitiveness	5
Combativeness	4½
Secretiveness	5
Acquisitiveness	4½
Constructiveness	2½
II. Sentiments.	
Cautiousness (very full)	6
Approbativeness	5
Self-esteem	4
Benevolence	3

[1] Phrenology, Boston, 1833.

Reverence	3
Firmness	4
Conscientiousness	4½
Hope	4½
Marvellousness	3
Ideality	4
Mirthfulness	3½
Imitation	2½

INTELLECTUAL ORGANS.

III. Perceptive.	
Individuality (large)	6
Configuration	2
Size	6
Weight and resistance	3½
Coloring	3
Locality	5
Order	2½
Calculation	2
Eventuality	5½
Time	2½
Tune	2½
Language (uncertain)	5?
IV. Reflective.	
Comparison	4½
Causality	5

This chart shows that the affective, or feeling faculties, prevail over the intellectual, in the proportion of 4.3 to 3.9; and the several groups of organs are developed in the following order:

Propensities	4.8
Reflective	4.7
Sentiments	3.9
Perceptive	3.8

Whether these figures can be relied upon as indicating the character and disposition of the individual to whom the skull belonged, may be doubted; though it will be perceived that their indications correspond with the general character of the aborigines, in the large cautiousness, individuality, &c., and the deficient constructiveness, calculation, &c.

But few implements, ornaments, or works of art of any kind, have been discovered in the mounds of Wisconsin, that could not be traced to recent Indian burials; and yet it is certain that had they been originally deposited, they would still be found there. The stone axes, flint arrow-heads, and articles of pottery, are of a durable character, and could not have decayed since the erection of the mounds. Hence, we conclude that the more ancient mound-builders of Wisconsin were not in the habit of making such deposits.

The tumulus opened by me at Waukesha (See Chapter II, page 28) contained a stone pipe, another of burned clay, and fragments of two vases. These were of the same general kind and composition as the pipes and pottery of the Indians so frequently turned up by the plough.

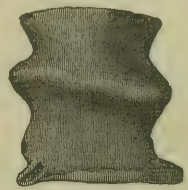
Fig. 39 represents the pipe found in or near the left hand of the skeleton. It consists of pottery made of the same materials as the ordinary vases or pots.

Fig. 40 was taken from the right hand of the same skeleton, and is made from

Fig. 39.

Two thirds natural size.

Fig. 40.



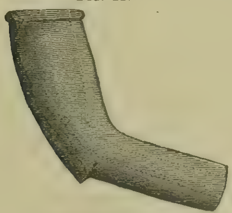
Natural size.

a kind of soft argillite of a purplish color. This pipe differs from all others that I have seen, by having the horizontal opening on both sides.

Fig. 41 is made of steatite, green variegated with white.

Fig. 42 is a large calumet, or pipe of peace, made of a fine-grained gray sandstone.

Fig. 41.



One half natural size.

Fig. 42.

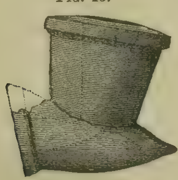
One half natural size.

Having been broken, it was mended with plates of lead. The small round punctures are supposed to represent the number of treaties which had been solemnized by this emblem. The drawing reduces the size one half.

Fig. 43 is of the same material as the last, but of finer texture.

Fig. 44 was found on the surface of the ground, on Lake Koshokenong. It has

Fig. 43.



Two thirds natural size.

Fig. 44.

One half natural size.

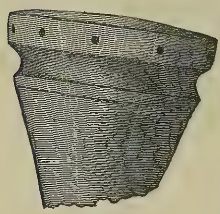
been burned and broken into fragments. It was apparently made of a like soft argillaceous sandstone.

Fig. 45 is a fragment of a pipe made of a reddish argillaceous stone.

Fig. 46 is of gray fine-grained sandstone, so soft that it was apparently cut and reduced to the proper form with a knife.

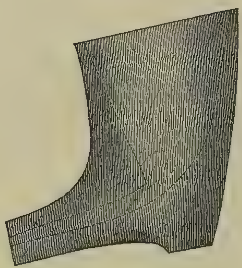
Fig. 47 is of the same material, in which was found a small nodule of iron pyrites;

Fig. 45.



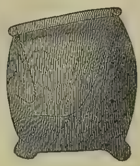
Natural size.

Fig. 46.



Natural size.

Fig. 47.



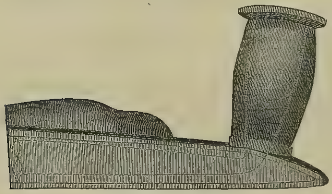
Natural size.

and the artist has taken advantage of this to ornament his work, and to leave a corresponding protuberance on the opposite side for symmetry. It was presented to me by Miss Amelia E. Higgins.

Fig. 48 is made of the beautiful red pipe-stone from the "Coteau des Prairies," and is probably also a calumet, or pipe of state.

Fig. 49 was made and used by the Menomonee Indians of the Neenah river, from a whitish stone, now injured by accidental fire.

Fig. 48.



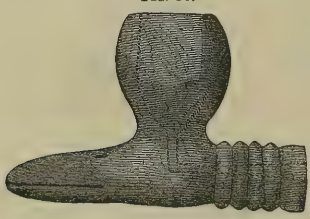
One half natural size.

Fig. 49.

One half natural size.

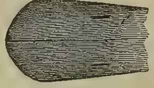
The pipe, Figs. 50 and 51, is of a dark-colored stone or clay slate, with traces of organic remains surrounded by iron pyrites. The end may be supposed to repre-

Fig. 50.



Two thirds natural size.

Fig. 51.



Two thirds natural size.

sent the head of a snake, or perhaps the bill of a duck. It belongs to Dr. P. R. Hoy, of Racine.

Fig. 39 is of artificial pottery. Figs. 40 and 50 are of argillite or clay slate rock. Fig. 41 is of steatite. Figs. 42, 43, 44, 46, and 47, are of gray sandstone, of a fine grain, and with argillaceous admixture. Fig. 45 is of reddish sandstone. Fig. 48 is of the red pipe-stone. Fig. 49 is of a whitish, or chalk-like stone.

In no one article was so much ingenuity displayed by aboriginal natives as in pipe making. Many of the pipes are formed with much taste, and are designed to be representations of animals with which they were familiar.

Arrow-points and spear-heads have occasionally been found in the mounds; but they mostly occur on, or not far beneath, the surface of the ground. They generally consist of schist or hornstone, usually denominated flint.

Fig. 52 represents an interesting form of arrow-point, narrower than usual, lozenge-shaped, and enlarged at the posterior extremity.

Fig. 52.

One half natural size.

Remains of broken pottery are found in the mounds, and also in great abundance wherever there has been an Indian settlement. The pots were formed by hand, of clay and sand, or fine gravel, occasionally mixed with broken shells and other substances, and then slightly burned. The potter's wheel, that most ancient of all machines, was evidently not in use among the aboriginal inhabitants of America.

The pots, or vases, found in the mounds at Waukesha and Racine, were in connection with the original deposit, and must, therefore, have been the work of the mound-builders. They agree in every respect with the fragments found about the old Indian villages; and probably with the same articles as now manufactured by the females of tribes residing on the Missouri.[1]

The vessels were variously ornamented by lines and dots stamped upon them, when in a soft state, by hand. Occasionally the whole surface is so marked, but usually the rim only is ornamented.

The vases obtained at Waukesha, and also at Aztalan, must have been broken before they were deposited in the mounds; for only portions of different vases could be found.

Fig. 53 represents the vase found in a mound at Racine, and restored by Dr. P. R. Hoy, described in Chapter I.[2]

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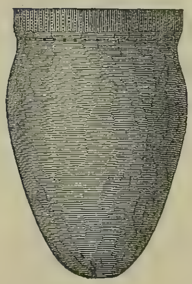
[1] Mr. Catlin informs us that "earthen dishes are made by the Mandan women in great quantities, and modelled in a thousand forms and tastes. They are made from a tough black clay, and baked in kilns which are made for the purpose, and are nearly equal in hardness to our own manufactured pottery, though they have not yet got the art of glazing. They make them so strong and serviceable, however, that they hang them over the fire as we do our iron kettles, and boil their meat in them with perfect success. Here women can be seen handling them by hundreds, moulding them in fanciful forms, and passing them through the kilns."—Catlin's North American Indians, I, 116; quoted in Squier's Antiquities of New York, page 132.

[2] That the state of the potter's art among the southern nations was not much more advanced than in Wisconsin, appears from the following extract: "The ancient pottery of Nicaragua is always well

Fig. 54 represents a stone axe. These axes are worked to a sharp edge at one end, and have a depression around the head for the handle. Although they all have the same general form, there are no two exactly alike. The one figured must have been used in the manner of a carpenter's adze. These are made of the hardest

Fig. 53.

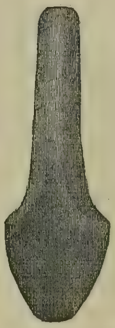


One third natural size.

Fig. 54.

One quarter natural size.

Fig. 55.



One half natural size.

Fig. 56.

One half natural size.

stone, selected from boulders very nearly of the right shape, so as to require the least labor. Some of them retain a portion of the natural polish of the boulder on the head and edges.

Figs. 55 and 56 represent a chisel-shaped instrument, which may have been employed in taking off the skins of large quadrupeds.

These stone chisels were perhaps made use of instead of the bone, in dressing skins of the bison as is now practised by the wild Indians of the West. The last process, termed *graining*, is performed by the squaws, who use a sharpened bone, the shoulder-blade or other large bone of the animal, sharpened at the edge, somewhat like an adze; with the edges of which they scrape the fleshy side of the skin, bearing on with the weight of their bodies, thereby drying and softening, and fitting it for service. (Catlin's North American Indians, I, 45.)

An image made of wood (Fig. 57) was discovered at Prairie village (Waukesha), soon after its first settlement by the whites, and presented to me by Mr. C. F. Warren. It is evident that it could have no very great antiquity; though it may have been preserved and handed down for several generations. It is quite rudely carved, the head very much flattened, and the general expression more that of a monkey than of a man.

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burned, and often elaborately painted in brilliant and durable colors. The forms are generally very regular, but there is no evidence of the use of the potter's wheel; on the contrary, there is reason to believe that the ancient processes have undergone little or no modification since the Conquest. The pottery now generally in use among all classes in Central America, is of the Indian manufacture, and is fashioned entirely by hand."—Squier's Nicaragua, 1852, II, 337–8.

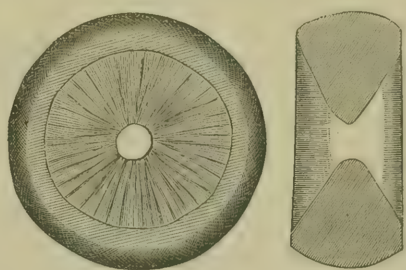
Such images were formerly common with the Indians, and are still to be found among the remote tribes, which retain many of their ancient customs. "Most of the Crees carry with them one or more small wooden figures rudely carved, some of which they state to be representations of a malicious or at least a capricious being named Kepuchikan (or Gepuchikan), to whom they make offerings." (J. Richardson's Arctic Searching Expedition, 1852, page 268.)

Fig. 58 represents a circular stone composed of variegated quartz, of a light gray

Fig. 57.

Two thirds natural size.

Fig. 58.



color, perforated; doubtless intended to be used in the Indian game of tchung-kee, as described by Catlin.[1]

[1] The Mandans have a game "which may be said to be their favorite amusement, and unknown to the other tribes about them. The game is tchung-kee (see Fig. 59), a beautiful athletic exercise which they

Fig. 59.

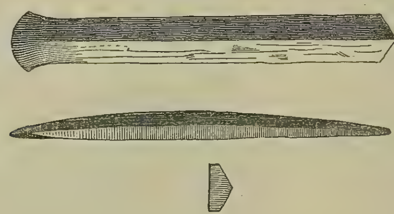
seem to be almost unceasingly practising whilst the weather is fair, and they have nothing else of moment to demand their attention. This game is decidedly their favorite amusement, and is played near to the village on a pavement of clay which has been used for that purpose until it has become as smooth and hard as a floor. For this game two champions form their respective parties, by choosing

This stone was found at Milwaukee, where it had doubtless been lost at some remote time. Its form is precisely such as to enable it to roll the greatest distance without falling.

Similar stones are found in Ohio, and are described by Messrs. Squier and Davis,[1] which were without doubt used for a like purpose.

Fig. 60 represents a chisel or implement of native copper, found at Stephen's

Fig. 60.



One half natural size.

Point on the upper Wisconsin river, in 1850, and deposited in the cabinet of the University of Wisconsin by Mr. James W. Wright. It appears to have originally had a sort of finish on the upper or convex side, and on the edges; but in many places it is decayed and gone. There are also indications of grinding or rubbing, on the surface. The under, or flat side, is full of irregular cavities, and was probably never smoothed. It is supposed to have been brought to its present shape by hammering, probably with a stone hammer.

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alternately the most famous players, until their requisite numbers are made up. Their bettings are then made, and their stakes are held by some of the chiefs, or others present. The play commences with two (one from each party), who start off upon a trot abreast of each other, and one of them rolls, in advance of them on the pavement, a little ring of two or three inches in diameter, cut out of a stone; and each one follows it up with his tchung-kee (a stick six feet in length, with little bits of leather projecting from its sides, of an inch or more in length), which he throws before him as he runs, sliding it along upon the ground after the ring, endeavoring to place it in such a position when it stops, that the ring may fall upon it, and receive one of the little projections of leather through it, which counts for game one, or two, or four, according to the position of the leather on which the ring is lodged. The last winner always has the rolling of the ring, and both start the tchung-kee together; if either fails to receive the ring, or to lie in a certain position, it is a forfeiture of the amount of the number he was nearest to, and he loses his throw; when another steps into his place. The game is a difficult one to describe so as to give an exact idea of it, unless one can see it played; it is a game of great beauty and fine bodily exercise, and these people become excessively fond of it."—Catlin's North American Indians, I,132.

A similar game was practised by the Senecas; as described by Lewis H. Morgan, in the Third Annual Report of the Regents of the University of New York, 1850, p. 79. [And likewise by the Upper Creeks. See Smithsonian Contributions, II, 135–140; Trans. Amer. Ethnol. Soc., III, 51–57.—*Secretary S. I.*]

[1] Smithsonian Contributions, I, 222.

CHAPTER VIII.

CONCLUDING REMARKS.

It seems proper to present here some general conclusions to which the facts detailed in the preceding pages lead the mind of the inquirer, though many of them have already been expressed.

The American race is now, and probably always has been, divided into numerous distinct tribes or nations, occupying different portions of the country, and each having to some extent its own peculiar habits, customs, religion, and even language. Many of the tribes were of a roving disposition, with no fixed place of abode; while others were more permanent, only leaving their villages for the purpose of war or the chase. Since these nations have been known to us, and their history recorded, we are cognizant of numerous and important changes in the location of different tribes, and even nations. We know of tribes that have become extinct, and of others that have gradually united with their neighbors, adopting their habits, religion, and language.

We may, therefore, without assuming any far-fetched theories, suppose that a nation or tribe of red men formerly occupied the country now known as Wisconsin, whose superstitions, ceremonies, and beliefs, required the erection of mounds of earth of the various forms represented on the plates accompanying this work; and that these tribes may have emigrated, or been driven off by others having no veneration for their ancient monuments. These subsequent tribes may or may not be the same that until very recently occupied that country. They extended their cultivation over the mounds with as little feeling of respect as is manifested by men of the race who are now fast destroying them. It is quite certain that these later tribes continued the practice of mound-building so far as to erect a circular or conical tumulus over their dead. This practice appears to be a remnant of ancient customs that connects the mound-builders with the present tribes.

The extent of the ancient works in the West indicates a condition of society somewhat different from the purely savage or hunter state: for to accomplish the labor required for the completion of such large structures, it would be necessary to accumulate the means of subsistence; and this could be done only by an agricultural people, or at least agriculture must have been among the pursuits of a people capable of constructing those works. Now we know that nearly all the Indian tribes cultivate the soil to some extent; and is it not reasonable to suppose that the amount of attention devoted to that pursuit may have been greater at former times than at present? A tribe or nation may gradually change its habits in rela-

tion to one or another class of pursuits, and yet remain essentially the same people. Again, the Indians are to a certain extent migratory; and hence we may look for the posterity of the mound-builders of Wisconsin in remote portions of the country.

Some tribes of the Dacotah or Sioux family, especially the Mandans and Aricaras (Ricaras, or Riccarees), are much more stationary and fixed in their habits than other tribes of Indians. "They cultivate corn, not only for their own use, but also enough to make it a very prominent article of trade."[1]

Dr. Morton says: "the *Osages, Minetaris, Mandans, Assinaboins,* and many cognate tribes, are more or less connected with the great Sioux nation;"[2] and that the *Osages, Omahas, Konsas, Missouris,* and *Ouapans,* all speak a language so nearly allied that they can severally converse with each other without an interpreter.[3]

It is quite probable that a more thorough knowledge of the habits, religious ceremonies, and superstitious beliefs of this great family, or group of families of Indians, would throw much light upon the obscure subject of the mounds, and perhaps unravel the mystery of their origin and uses.

The ancient works in Wisconsin are mostly at the very places selected by the present Indians for their abodes; thus indicating that the habits, wants, modes of subsistence, &c., of their builders, were essentially the same.

If the present tribes have no traditions running back as far as the times of Allouez and Marquette, or even to the more recent time of Jonathan Carver, it is not strange that none should exist in regard to the mounds, which must be of much earlier date.

It is by considerations of this nature that we are led to the conclusion that the mound-builders of Wisconsin were none others than the ancestors of the present tribes of Indians.

There is some evidence of a greater prevalence than at present of prairie or cultivated land in this State, at no very remote age. The largest trees are probably not more than five hundred years old; and large tracts of land are now covered with forests of young trees, where there are no traces of an antecedent growth. Every year the high winds prostrate great numbers of trees; and frequent storms pass through the forest, throwing down nearly every thing before them. Trees are left with a portion of the roots still in the ground, so as to keep them alive for several years after their prostration. These "wind-falls" are of frequent occurrence in the depths of the forests, and occasion much difficulty in making the public surveys. The straight lines of the sections frequently encounter them, as may be seen by the accompanying map. (Fig. 61.)

The amount of earth adhering to the roots of a tree when prostrated by the wind, is, under favorable circumstances, very considerable, and upon their decay forms an oblong mound of greater or less magnitude, and a slight depression is left where the tree stood. These little hillocks are often, by the inexperienced, mistaken for Indian graves. From the paucity of these little "tree-mounds" we infer that no

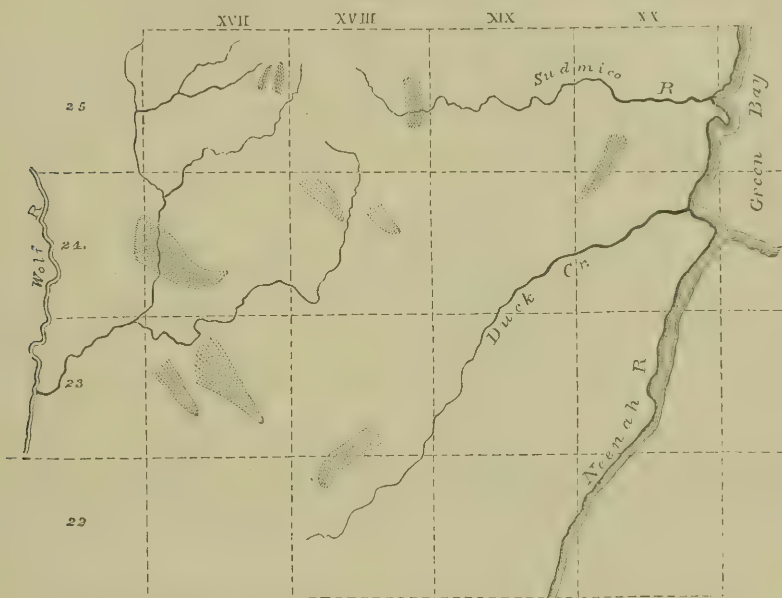
[1] T. A. Culbertson's Journal, in 5th Annual Report of the Smithsonian Institution, p. 118.

[2] Crania Americana, pp. 199, 200.

[3] The Winnebagos are a branch of the Sioux stock. Gallatin's Synopsis, p. 120.

very great antiquity can be assigned to the dense forests of Wisconsin; for during a long period of time, with no material change of climate, we would expect to find

Fig. 61.



Map showing "Wind-falls," reported by the Surveyors of the Public Lands. Six miles to one inch.

great numbers of these little monuments of ancient storms scattered every where over the ground.

Whether the greater extent of treeless country in former times was owing to natural or artificial causes, it is now difficult to determine; but the great extent of ancient works within the depths of the present forests, would seem to indicate that the country was at least kept free from trees by the agency of man.

Many of these tree-mounds were observed on and about the ancient works.

Another curious circumstance that may be noticed by inspection of the figures of mounds accompanying this work, is the gradual transition, as it were, or change of one form into another. Examples can be found of all forms, from a true circle, through the oval and elongated oval, to the oblong mounds and long ridges. Again, there is a succession of mounds, from the simple ridge of considerable size at one end, and gradually diminishing to a point at the other, through the intermediate forms, having one, two, three, or four projections, to the "turtle form." In this way, also, we may trace a gradual development (so to speak) of nearly all the more complicated forms.

It is not pretended to assert that this was the order in which the mounds were erected; or that the aborigines gradually acquired the art by successive essays or

lessons. Indeed, we are led to believe that the more complicated forms are the most ancient.

The relative ages of the different works in Wisconsin, so far as they can be ascertained from the facts now before us, are probably about as follows:

First and oldest. The animal forms, and the great works at Aztalan.

Second. The conical mounds built for sepulchral purposes, which come down to a very recent period.

Third. The indications of garden-beds planted in regular geometrical figures or straight lines.

Fourth. The plantations of the present tribes, who plant without system or regularity.

Thus the taste for regular forms and arrangements, and the habits of construction with earthy materials, seem to have been gradually lost, until all traces of them disappear in our modern degenerate red men.

The animal-shaped mounds, and accompanying oblongs and ridges, constituting the first of the above series, are composed of whitish clay, or of the subsoil of the country.[1]

The mounds of the second series, or burial-mounds, are usually composed of black mould or loam, promiscuously intermixed with the lighter-colored subsoil.

The animal-shaped mounds appear to be peculiar to Wisconsin; for the few obscure instances noticed in Ohio, by Messrs. Squier and Davis, can hardly be deemed an exception to this remark. They indicate a difference in the character of the people occupying these regions, but not greater than often exists between the neighboring tribes or nations.

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[1] It has been observed that the diluvial or drift clays, whether red, yellow, or blue in their original beds, assume a whitish color when exposed to the sun and dried.

ALPHABETICAL INDEX.

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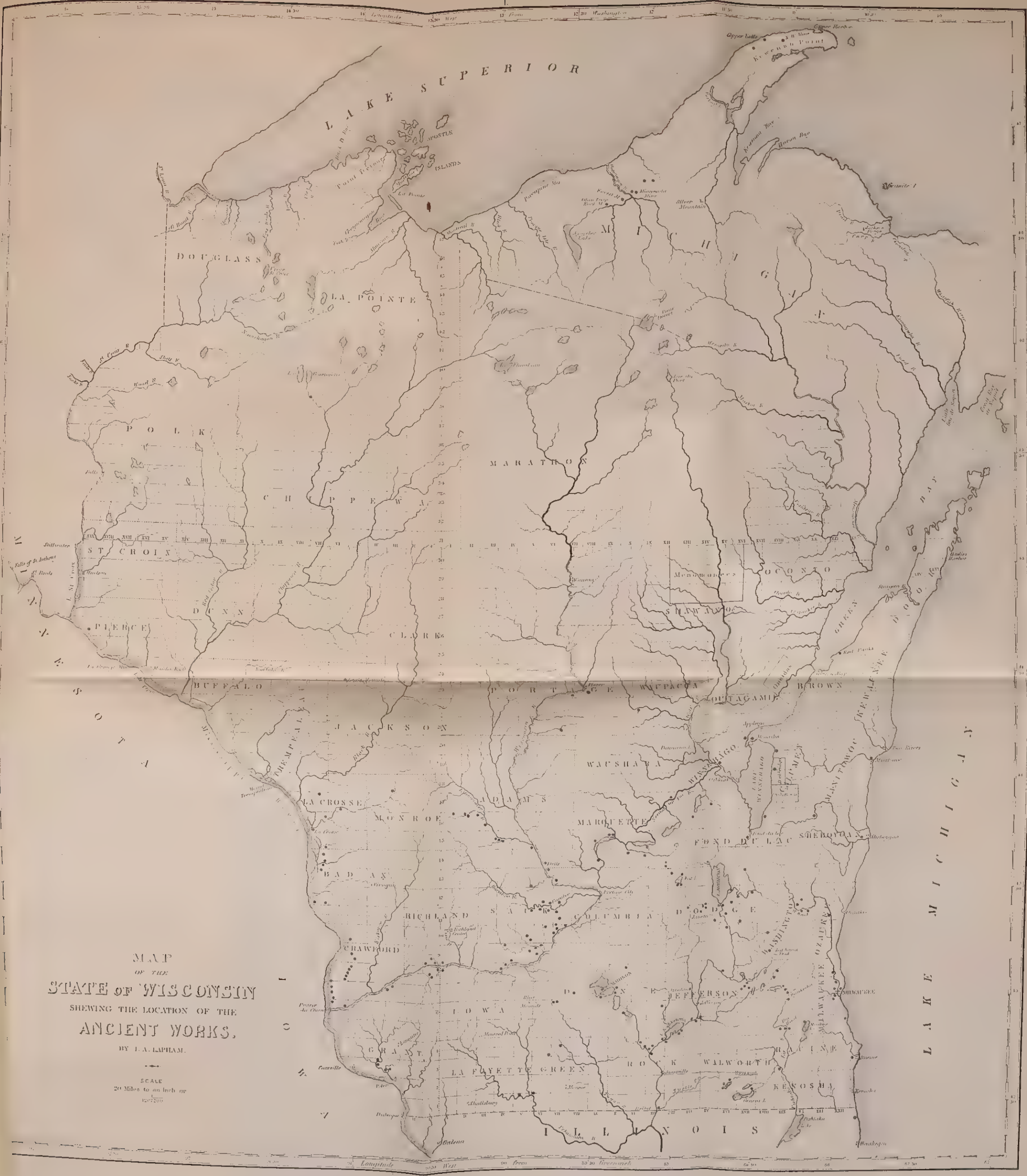
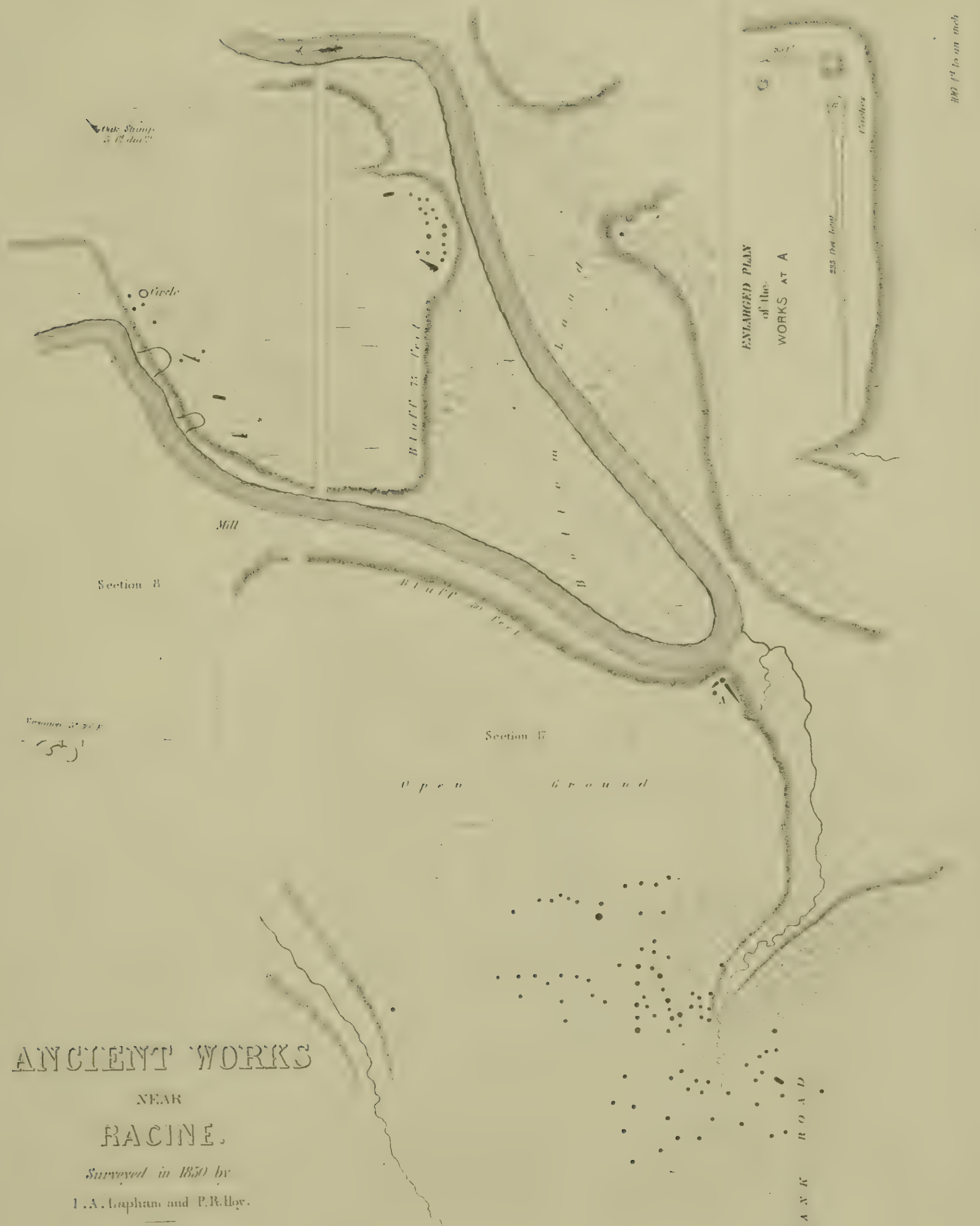
ERRATA.

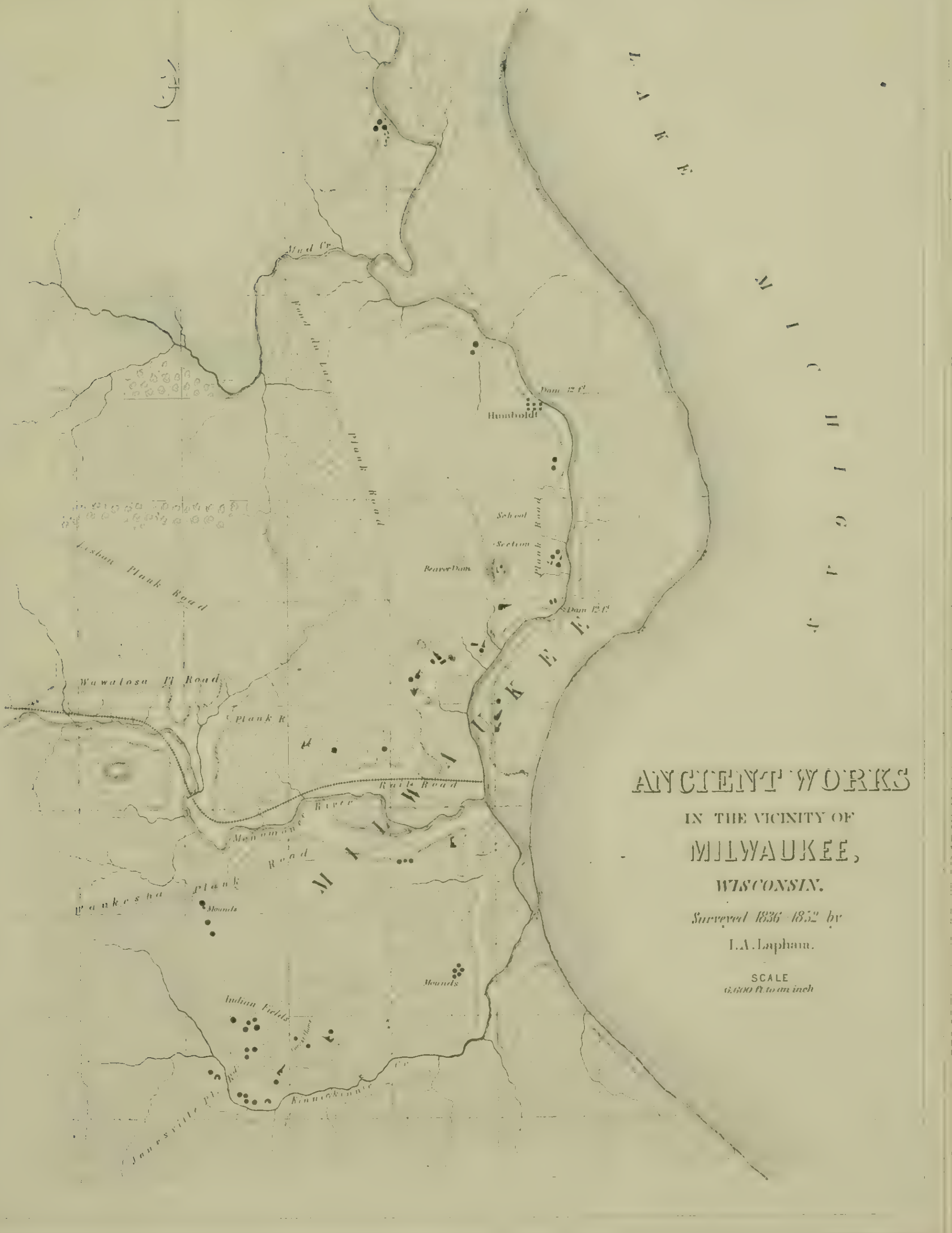
Page 66, line 10, *for* "eleven hundred," *read* "eleven thousand."
" 72, " 22, *for* "Mors Creek," *read* "Maus' Creek."
" 72, " 34, *for* "Moss Creek," *read* "Maus' Creek."
" 73, " 15, *for* "730 chains," *read* "7.30 chains."
" 77, " 17, *for* "page 368," *read* "page 66."
" 82, " 45, *for* "page 173," *read* "page 28."
" 88, " 32, *for* "page 79," *read* "page 81."


Copper Harbor
Copper Falls
N. W. Mine
Kewenau Point

I.


MAP
OF THE
STATE OF WISCONSIN
SHEWING THE LOCATION OF THE
ANCIENT WORKS,
BY I. A. LAPHAM.
SCALE
20 Miles to an Inch
LAKE SUPERIOR
APOSTLE ISLANDS
DOUGLASS
LA POINTE
POLK
CHIPPEWA
MARATHON
MICHIGAN
ST. CROIX
DUNN
PIERCE
CLARK
OCONTO
SHAWANO
BUFFALO
PORTAGE
WAUPACA
OUTAGAMIE
BROWN
JACKSON
WAUSHARA
WINNEBAGO
CALUMET
MANITOWOC
KEWAUNEE
DOOR
GREEN BAY
LA CROSSE
MONROE
ADAMS
MARQUETTE
FOND DU LAC
SHEBOYGAN
BAD AX
SAUK
COLUMBIA
DODGE
WASHINGTON
OZAUKEE
RICHLAND
CRAWFORD
IOWA
JEFFERSON
MILWAUKEE
GRANT
LA FAYETTE
GREEN
ROCK
WALWORTH
RACINE
KENOSHA
ILLINOIS
LAKE MICHIGAN
MINNESOTA
Longitude West from Greenwich
Longitude West from Washington


Circle
Mill
Section 8
Section 17
Open Ground
Bottom Land
ENLARGED PLAN of the WORKS AT A
Cedars
PLANK ROAD
ANCIENT WORKS
NEAR
RACINE.
Surveyed in 1850 by
I. A. Lapham and P. R. Hoy.
SCALE



ANCIENT WORKS

IN THE VICINITY OF

MILWAUKEE,

WISCONSIN.

Surveyed 1836–1852 by

I. A. Lapham.

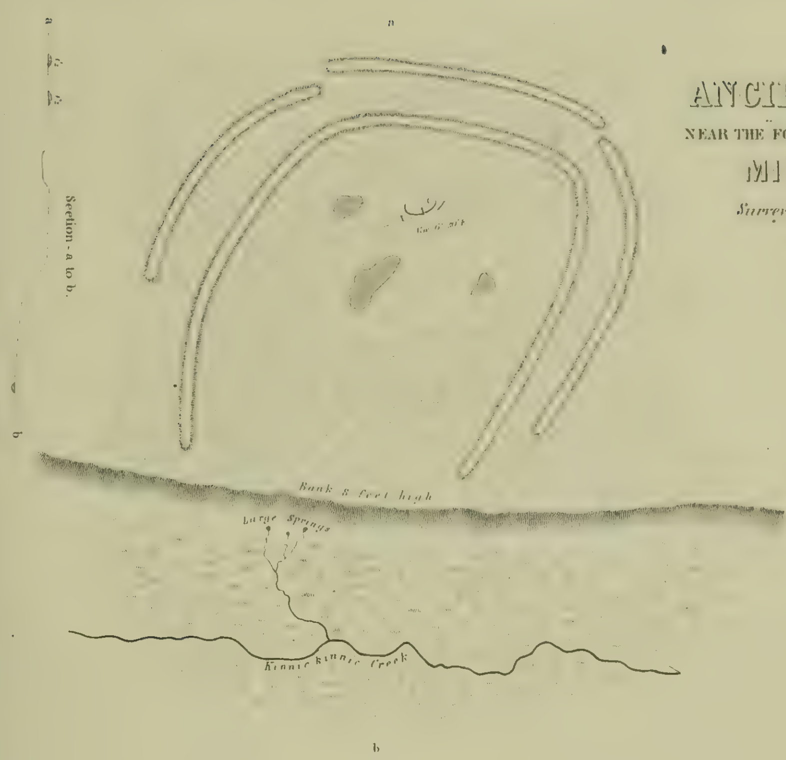
SCALE
6,600 ft. to an inch

No. 1

ANCIENT WORK
NEAR THE FOREST HOME CEMETERY
MILWAUKEE

Surveyed, April 1851 by
I. A. Lapham.

SCALE
10 ft. to an inch.

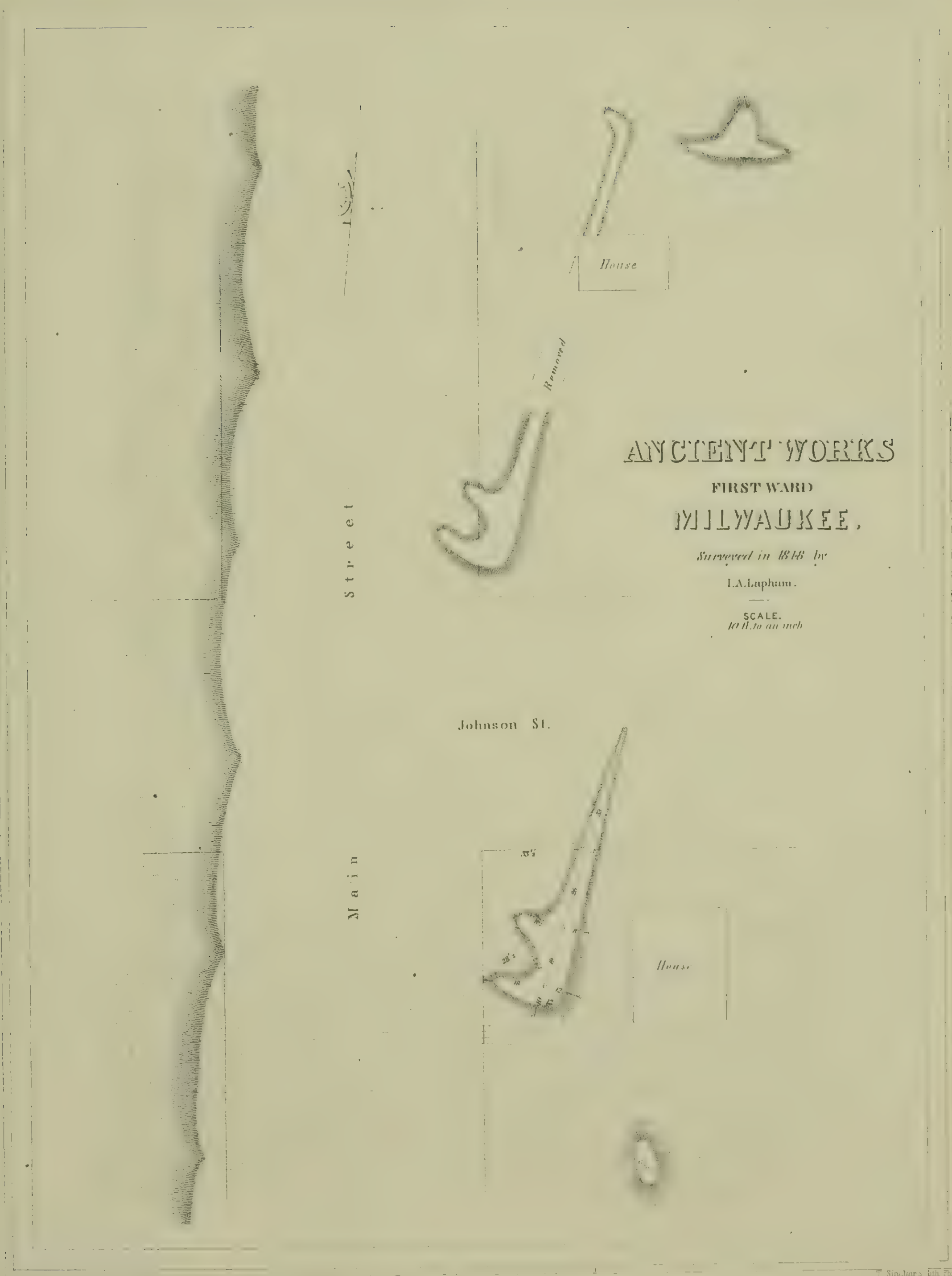


No. 2

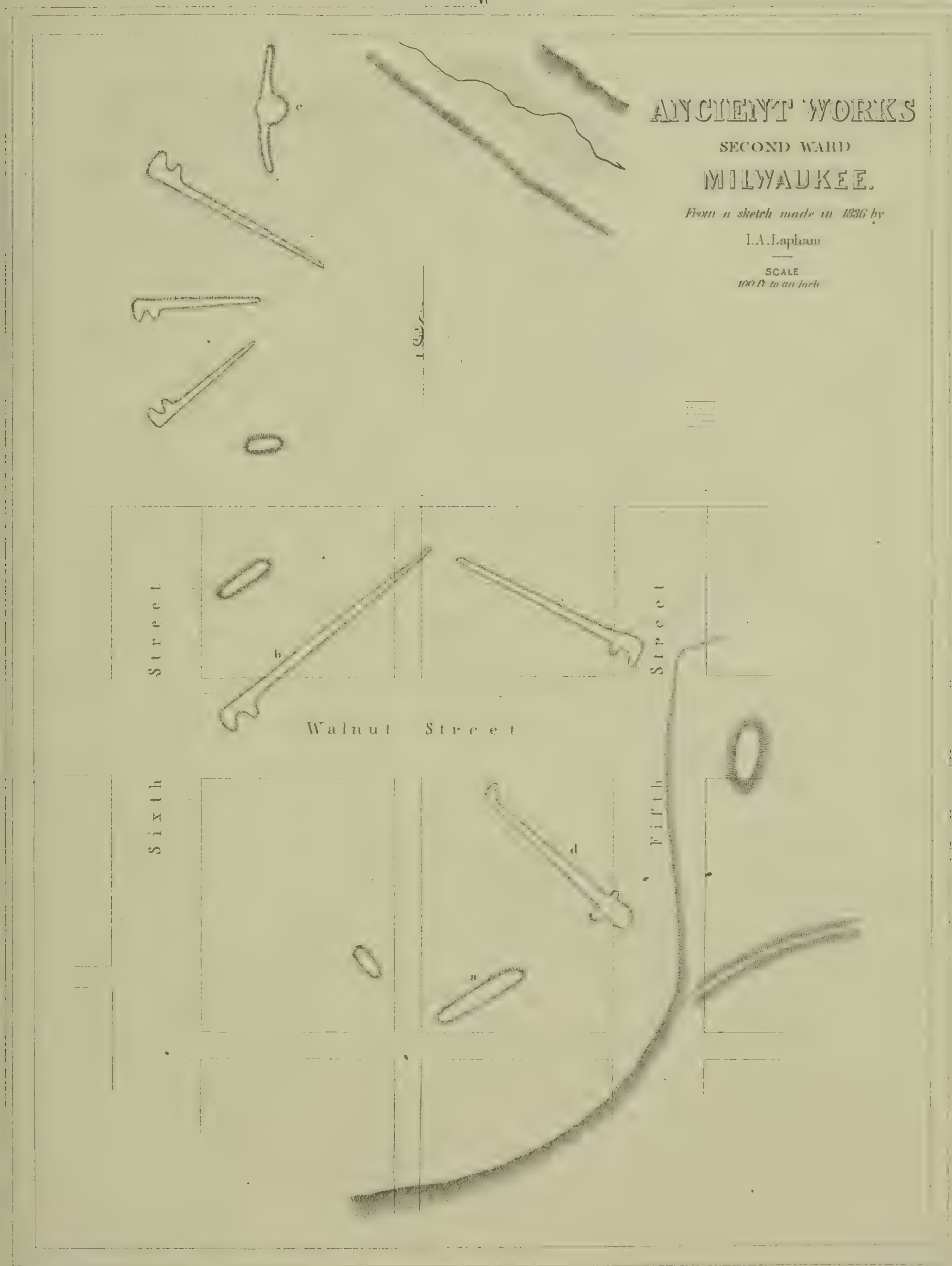
Block 33, Sherman's Addition
MILWAUKEE.
Surveyed in 1848 by I.A. Lapham.
Scale — *40 ft. to an inch.*

I. A. Lapham, Del.

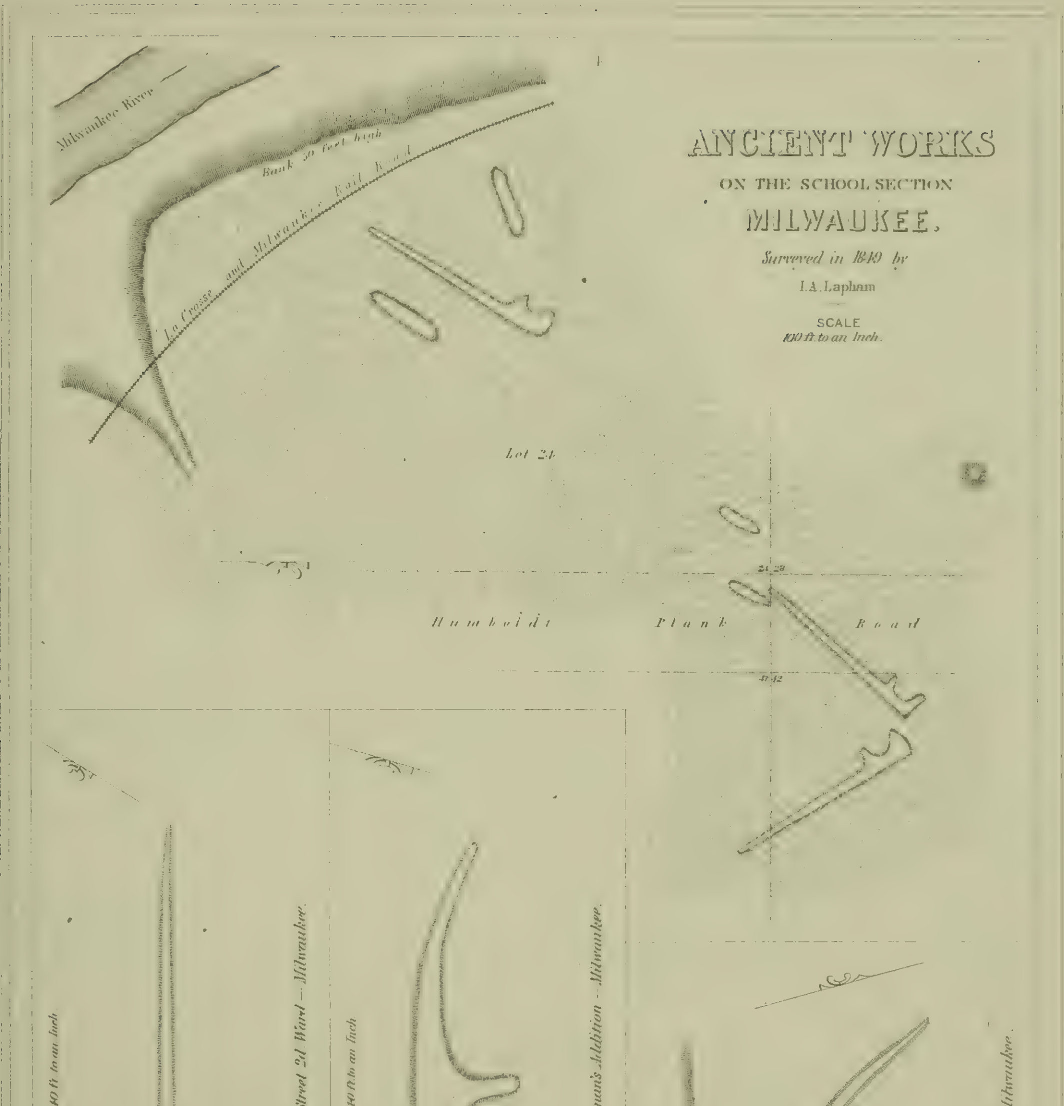
Lith.



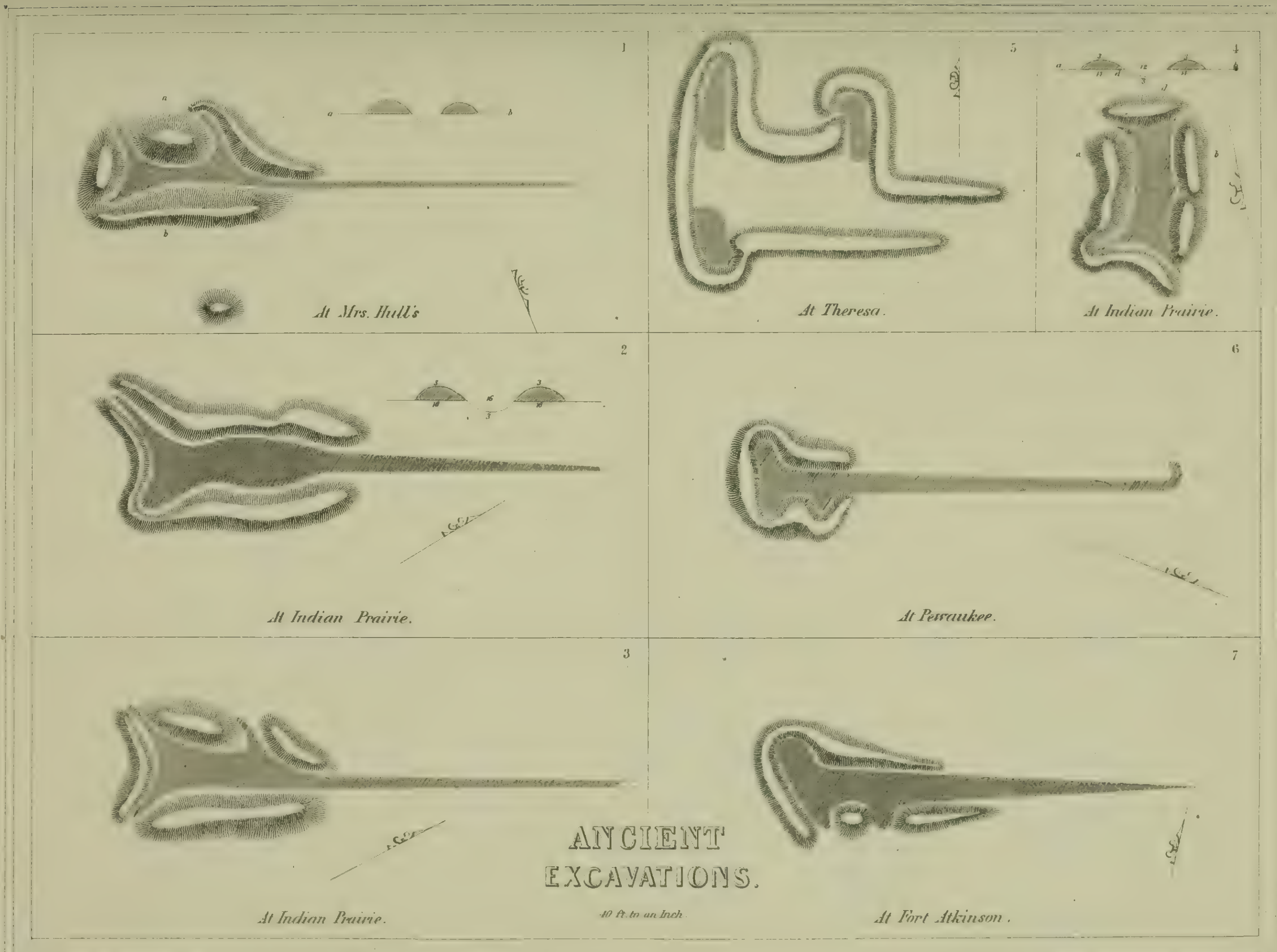
I.A. Lapham, Del. T. Sinclair's lith. Phil.



T. Sinclair's lith. Phil

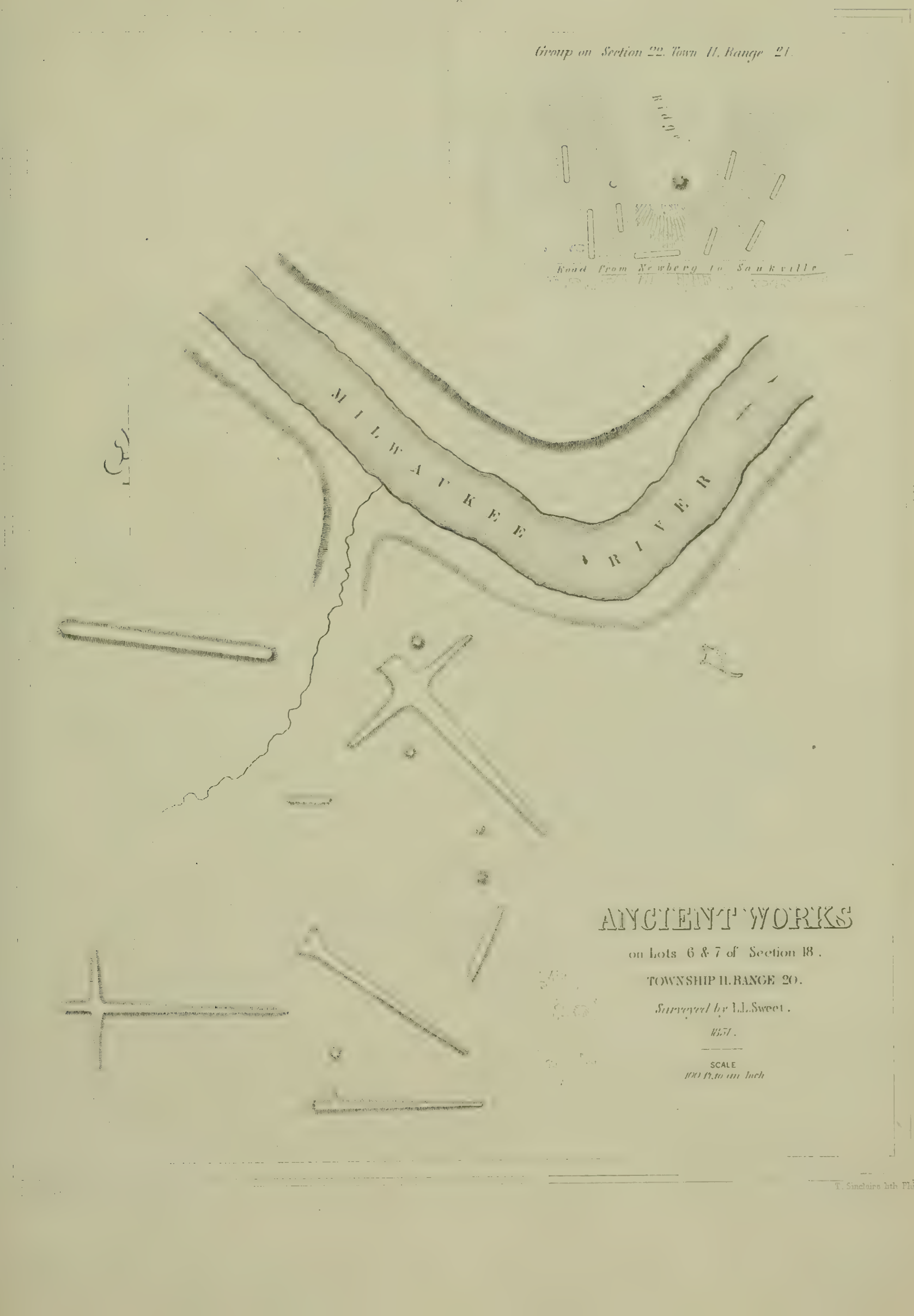

ANCIENT WORKS
ON THE SCHOOL SECTION
MILWAUKEE.
Surveyed in 1849 by
I.A. Lapham
SCALE
100 ft. to an Inch.
Milwaukee River
Bank 50 feet high
La Crosse and Milwaukee Rail Road
Lot 24
Humboldt Plank Road
40 ft. to an Inch
Lot 88, Beaubian Street 2d Ward — Milwaukee.
1
40 ft. to an Inch
Block 36, Sherman's Addition - Milwaukee.
2
40 ft. to an Inch
Block No. 120, Second Ward Milwaukee.
3


ANCIENT WORKS
AT
INDIAN PRAIRIE
[TOWN 8 RANGE 22]
Surveyed, May 1850 by I.A. Lapham.
SCALE
250 ft. to an Inch.
MILWAUKEE RIVER
Steep Bank 30 feet high
Indian Graves
Prairie
a
b
Excavations
Bank 12 feet high
Lowland Marsh
The Indian Graves.
SECTION
of the "Garden Beds".
THE
CROSS

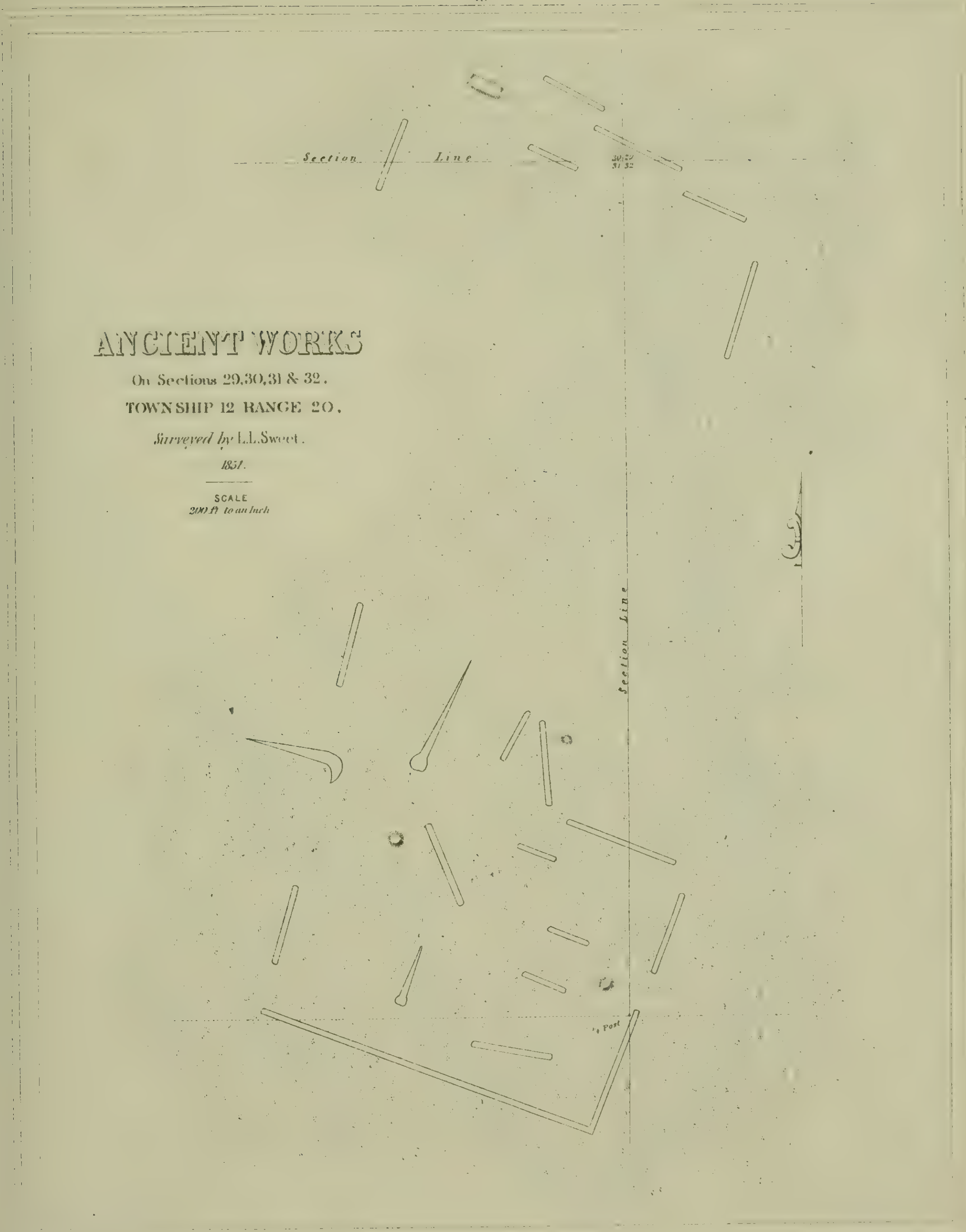


I.A. Lapham Del

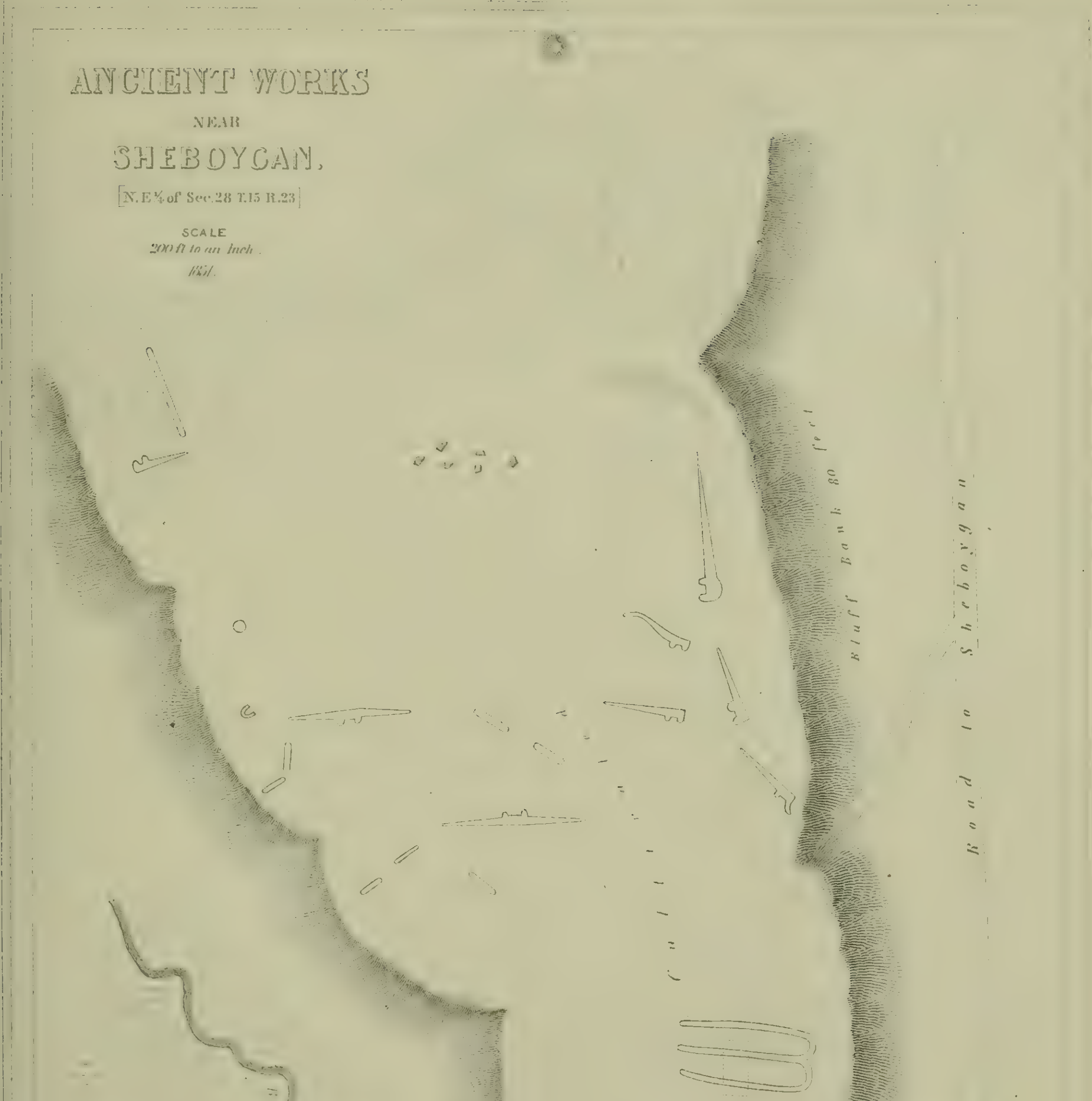
T. Sinclair's lith. Phil



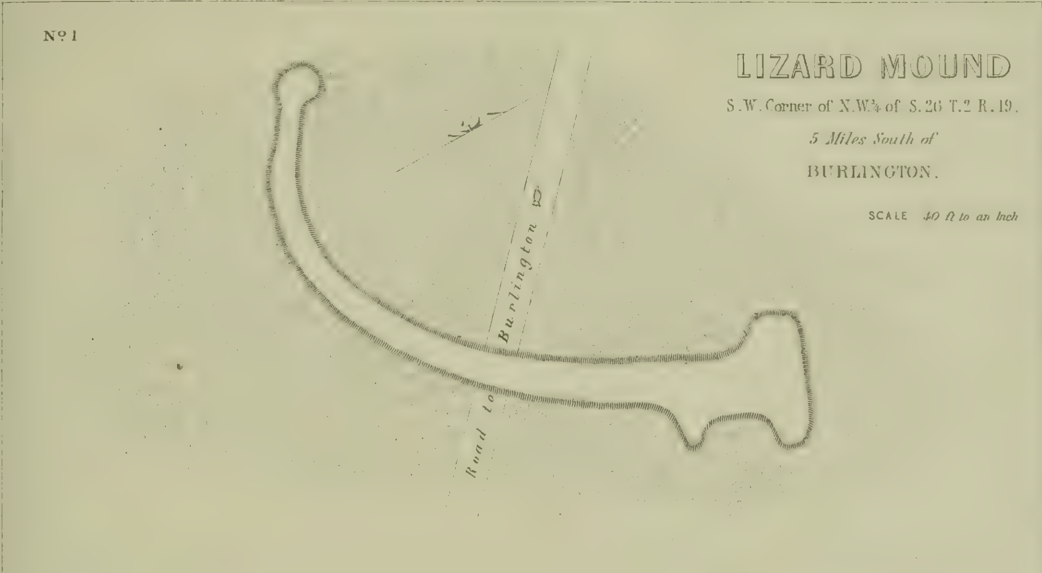
T. Sinclairs lith Phil



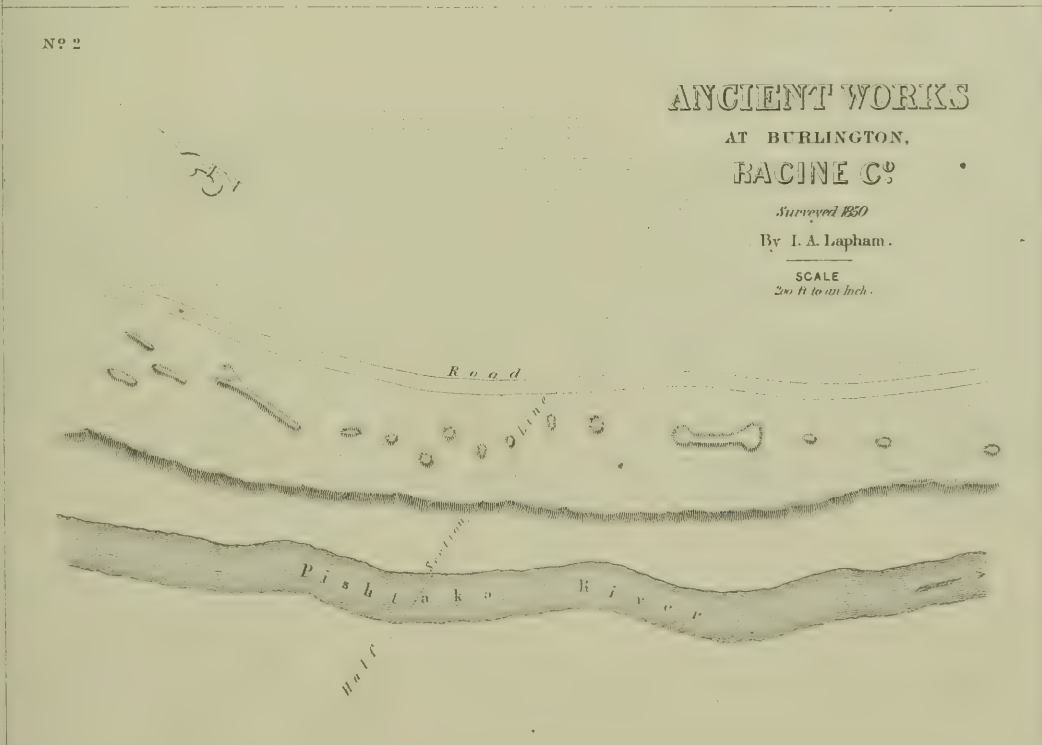
T. Sinclair's Lith. Phil.

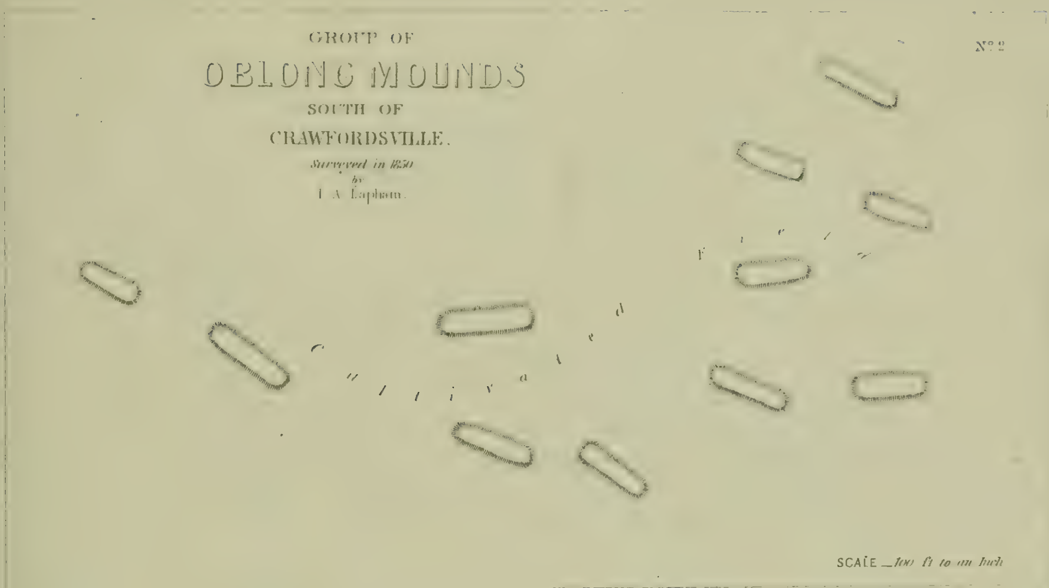

ANCIENT WORKS
NEAR
SHEBOYGAN,
[N.E¼ of Sec.28 T.15 R.23]
SCALE
200 ft to an Inch.
1851.
Bluff Bank 80 feet
Road to Sheboygan
Large Spring

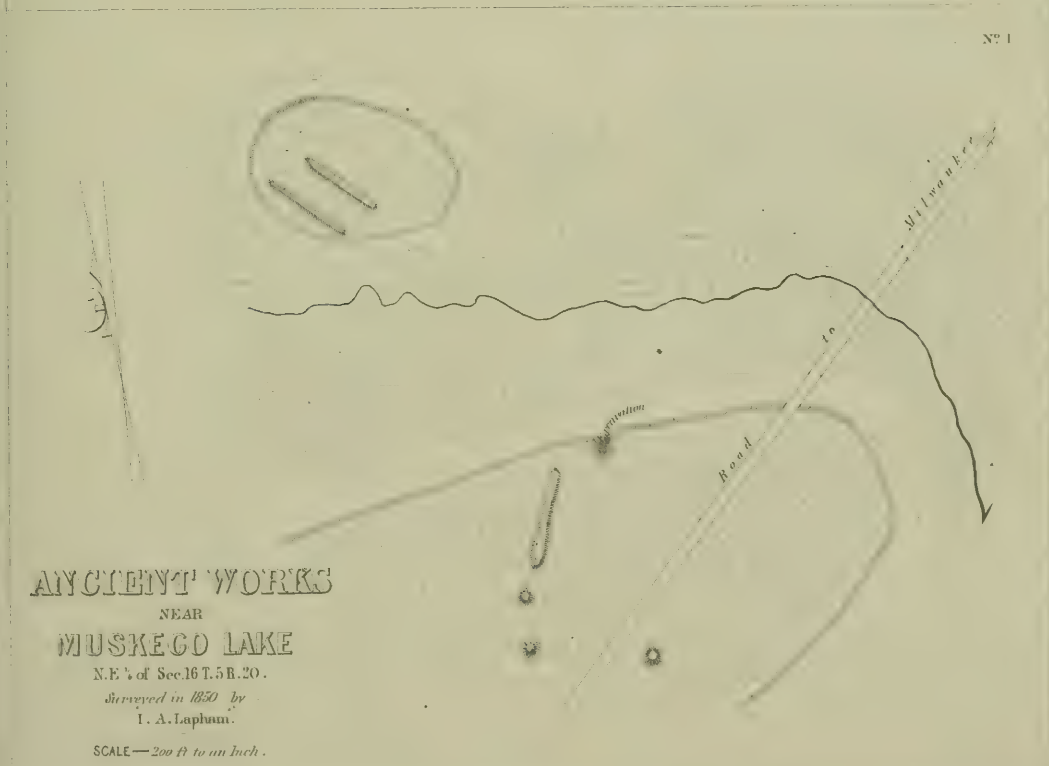
No. 1


LIZARD MOUND
S.W. Corner of N.W.¼ of S.26 T.2 R.19.
5 Miles South of
BURLINGTON.
SCALE 40 ft to an Inch
Road to Burlington

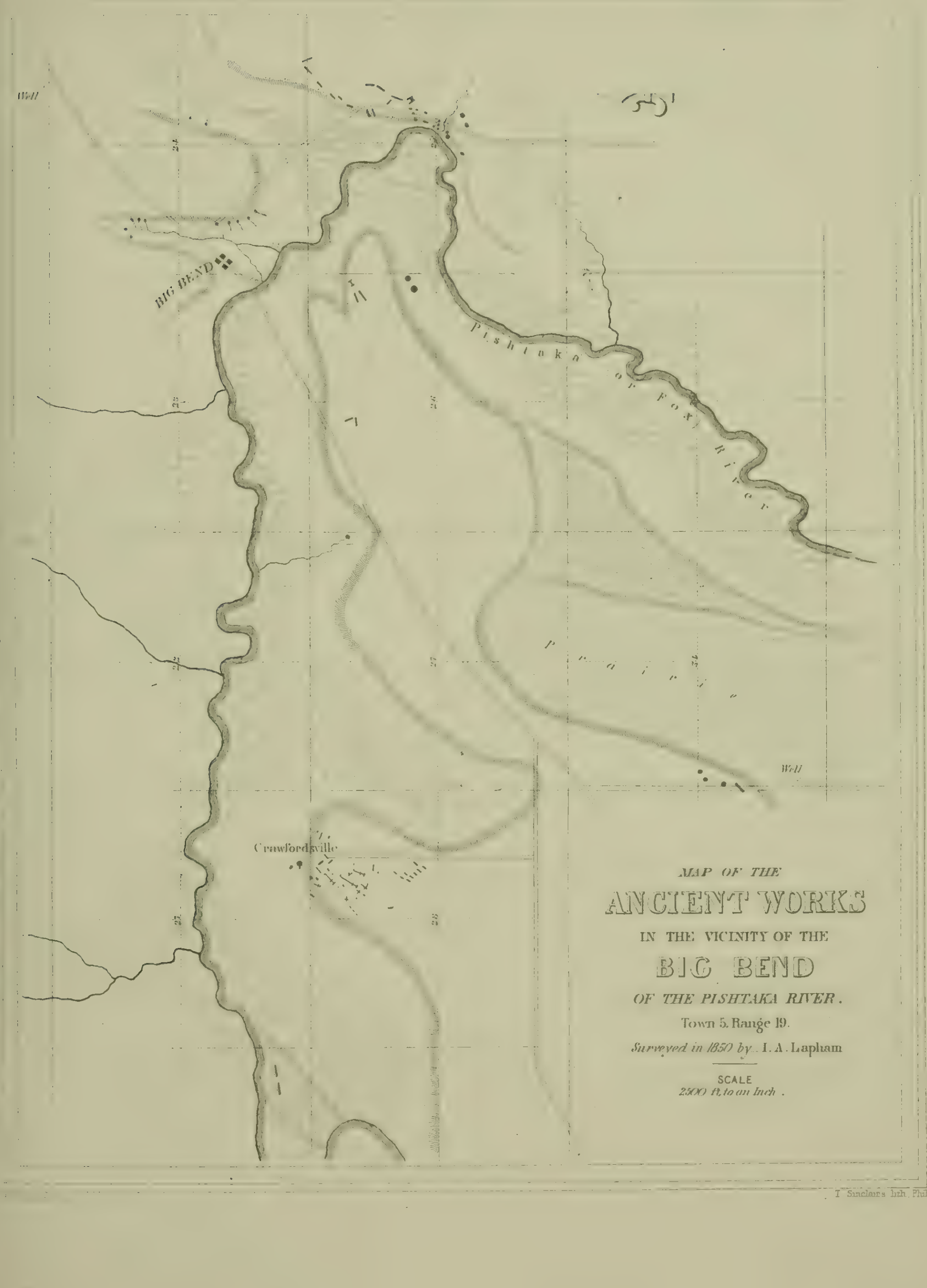
No. 2

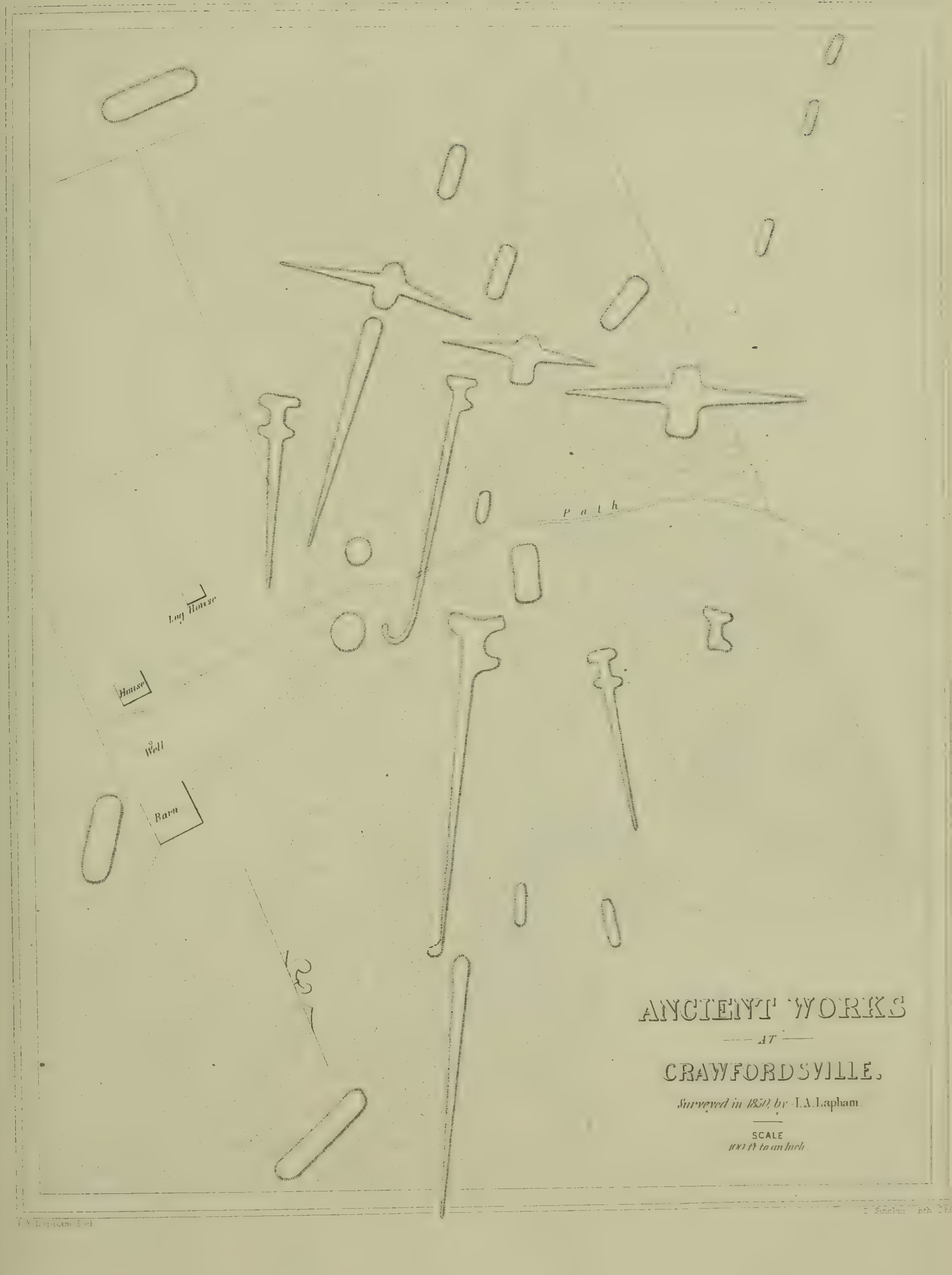

ANCIENT WORKS
AT BURLINGTON,
RACINE Co.
Surveyed 1850
By I. A. Lapham.
SCALE
200 ft to an Inch.
Road
Pishtaka River
Half Section line



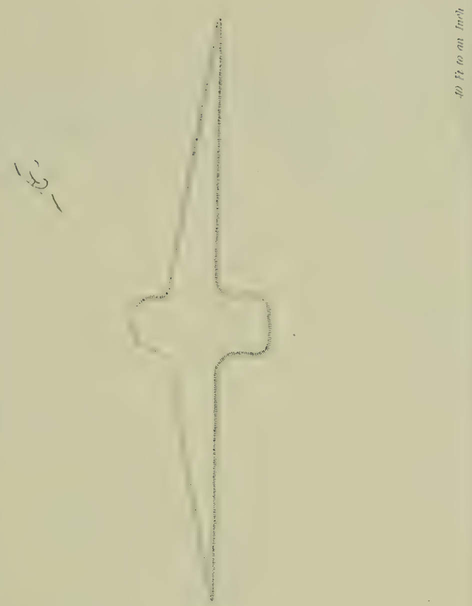


T. Sinclair's lith Phil.

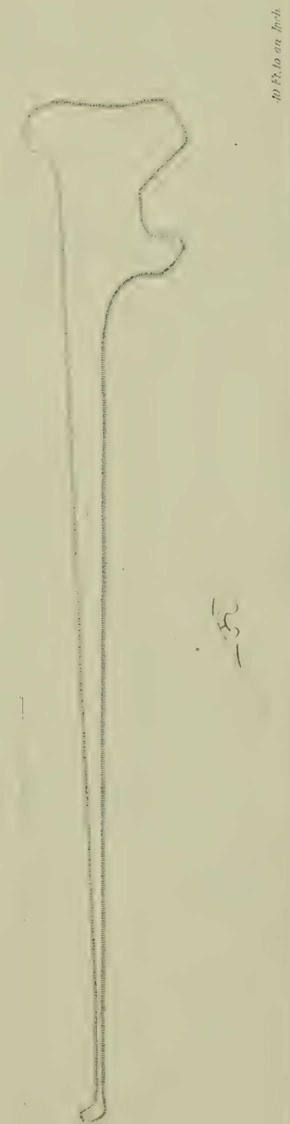

Well
BIG BEND
Pishtaka or Fox River
Prairie
Well
Crawfordsville
24
25
26
27
28
MAP OF THE
ANCIENT WORKS
IN THE VICINITY OF THE
BIG BEND
OF THE PISHTAKA RIVER.
Town 5. Range 19.
Surveyed in 1850 by I. A. Lapham
SCALE
2500 ft. to an Inch.
T. Sinclair's lith. Phil.


Path
Log House
House
Well
Barn
ANCIENT WORKS
AT
CRAWFORDSVILLE.
Surveyed in 1850, by I. A. Lapham.
SCALE
100 ft to an Inch.

No. 1.

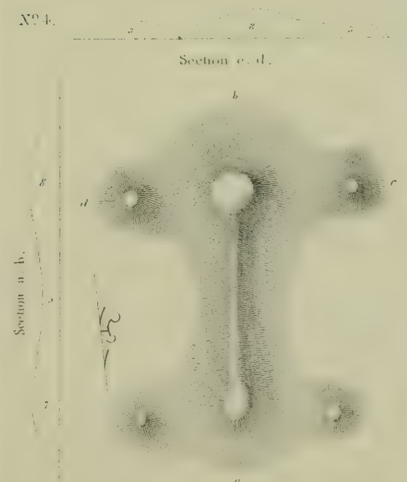


No. 2.

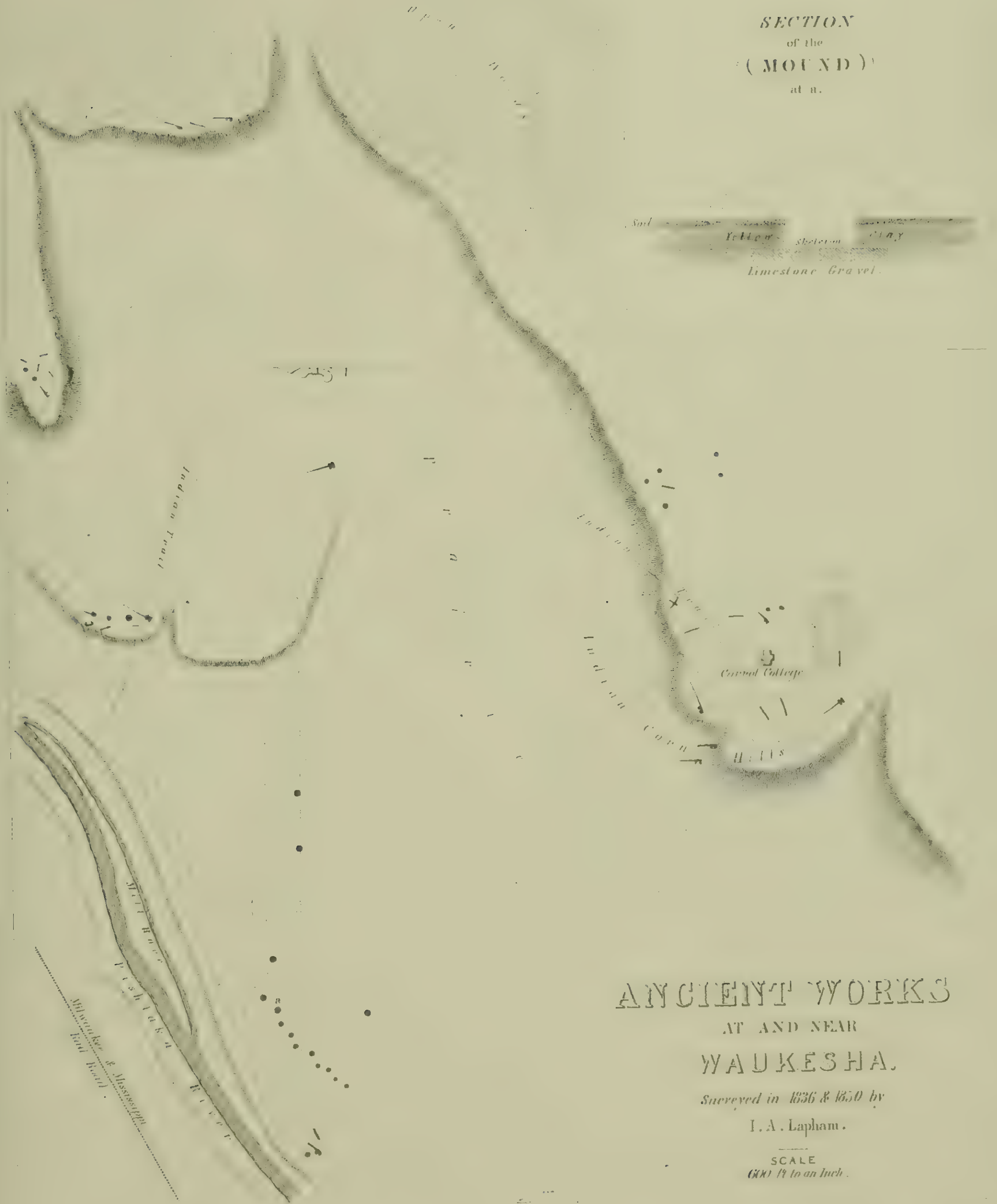


No. 3.

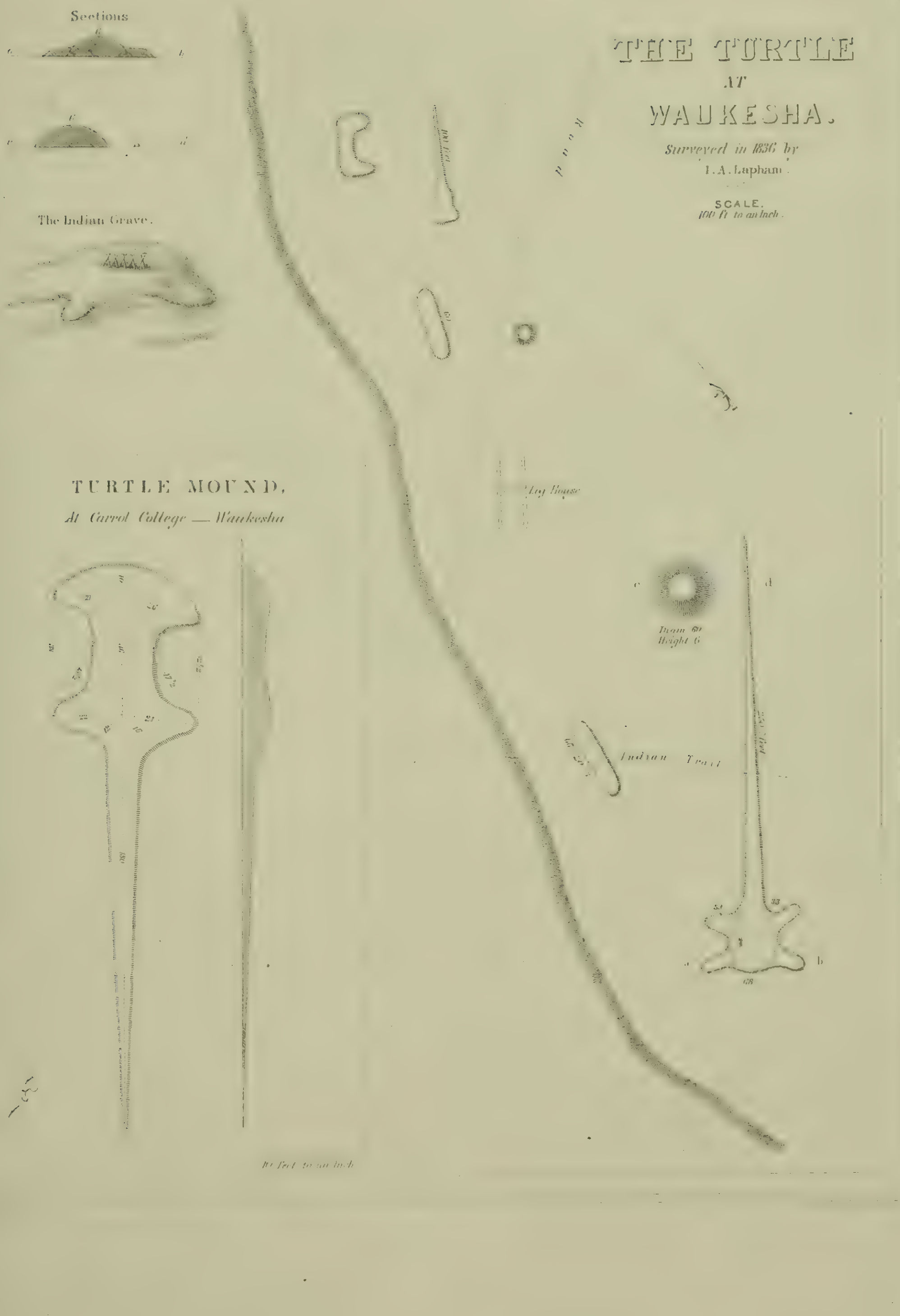
No. 4.



40 Ft. to an Inch.


SECTION
of the
(MOUND)
at a.
Soil
Yellow
Skeleton
Clay
Limestone Gravel
Indian Trail
Indian Corn Hills
Carroll College
Mill Race
Peshtaka River
Milwaukee & Mississippi
Rail Road
ANCIENT WORKS
AT AND NEAR
WAUKESHA.
Surveyed in 1836 & 1850 by
I. A. Lapham.
SCALE
600 ft to an Inch.

XIX.


Sections
The Indian Grave.
TURTLE MOUND,
At Carrol College — Waukesha
THE TURTLE
AT
WAUKESHA.
Surveyed in 1836 by
I. A. Lapham.
SCALE.
100 ft to an Inch.
Log House
Indian Trail
Diam 60
Height 6

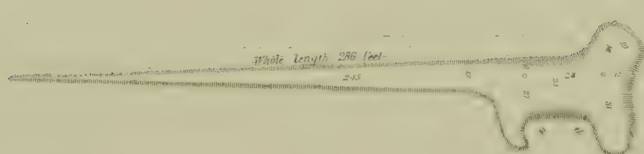
1

BIRD HILL
WAUKESHA,

Surveyed in May 1850, by— I. A. Lapham.

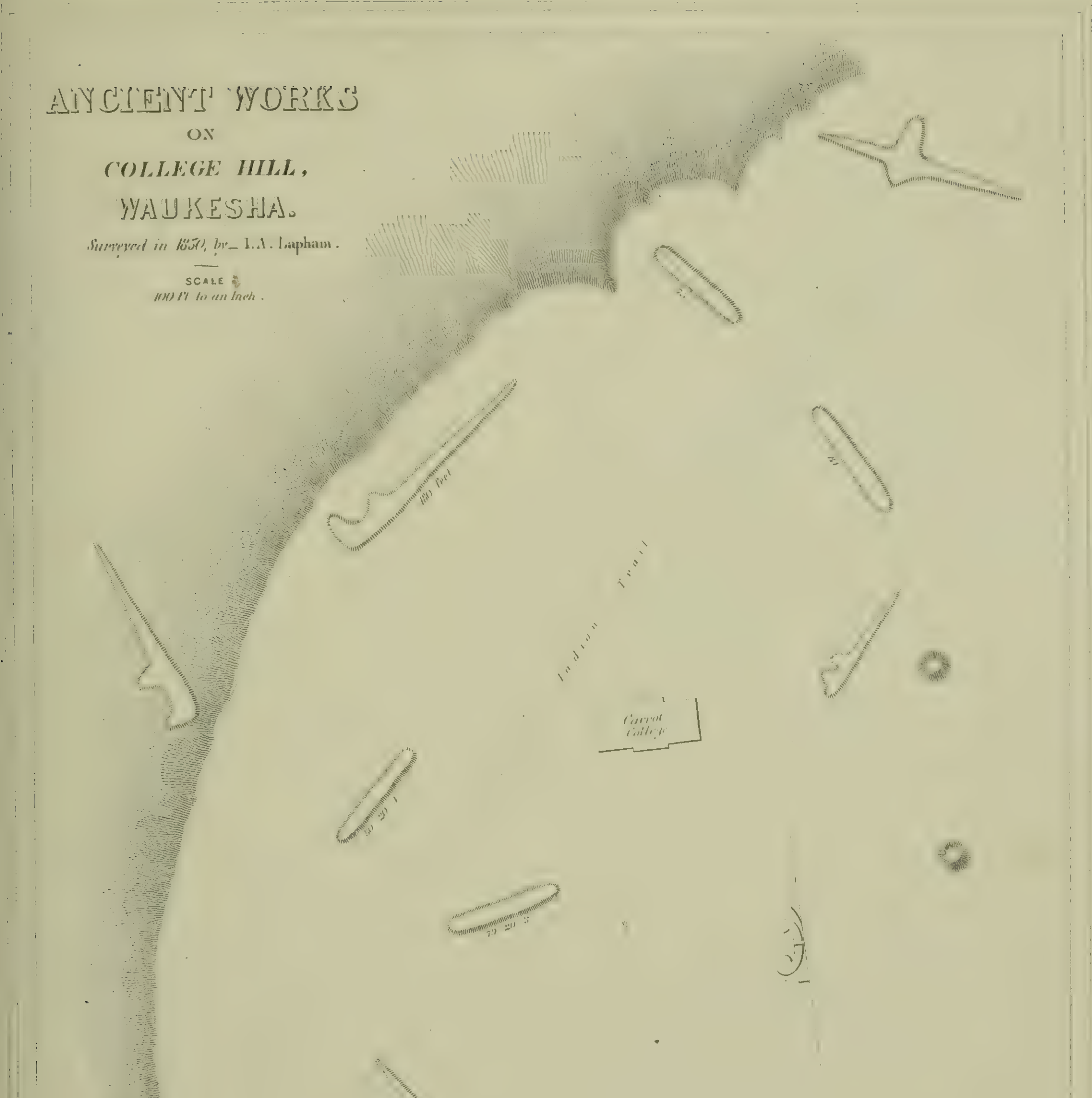
SCALE

2



AT
WAUKESHA
May 1850.

T. Sinclair's lith. Phil.a


ANCIENT WORKS
ON
COLLEGE HILL,
WAUKESHA.
Surveyed in 1850, by I. A. Lapham.
SCALE
100 Ft to an Inch.
Indian Trail
College Grove

No 2.

AT

WAUKESHA

Surveyed May 1850.

40 ft to an inch.

No 3.

AT

WAUKESHA

Surveyed May 1850.

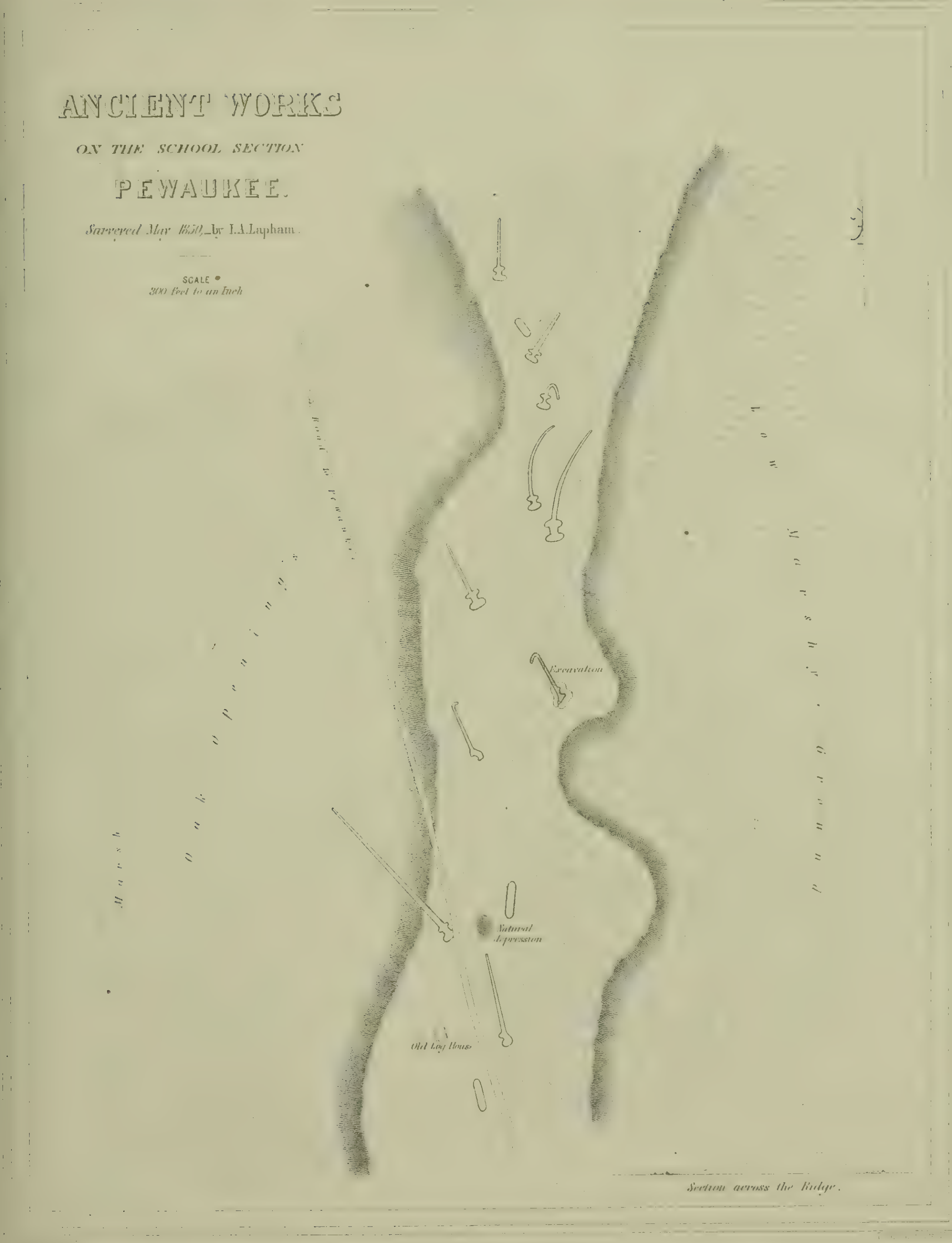
40 ft. to an inch.

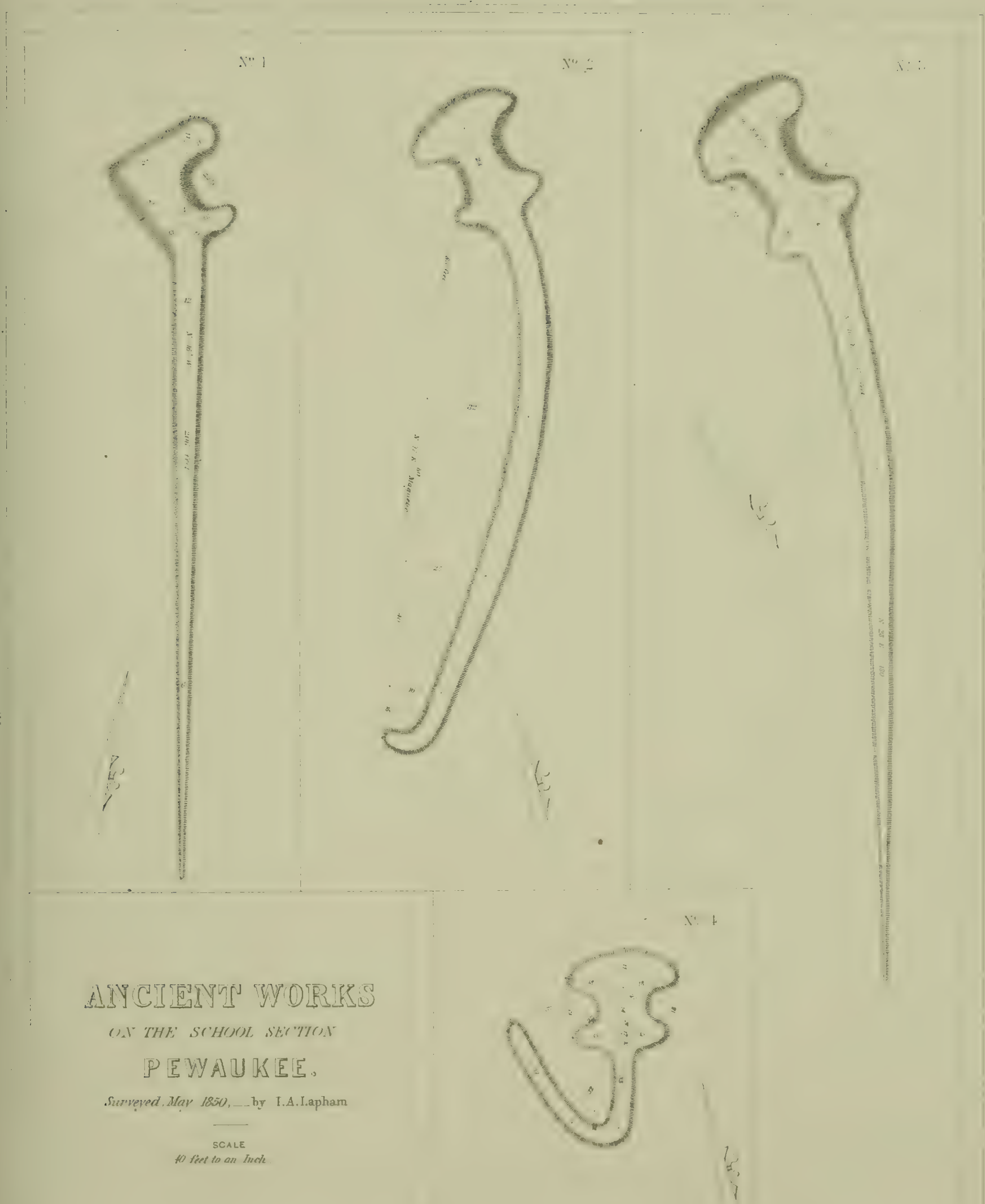
No 1.

THE BIRD — *WAUKESHA.*

Surveyed May 1850.

10 ft to an inch.


ANCIENT WORKS
ON THE SCHOOL SECTION
PEWAUKEE.
Surveyed May 1850, by I.A. Lapham.
SCALE
300 Feet to an Inch
Road to Pewaukee
Oak Openings
Marsh
Low Marshy Ground
Excavation
Natural depression
Old Log House
Section across the Ridge.



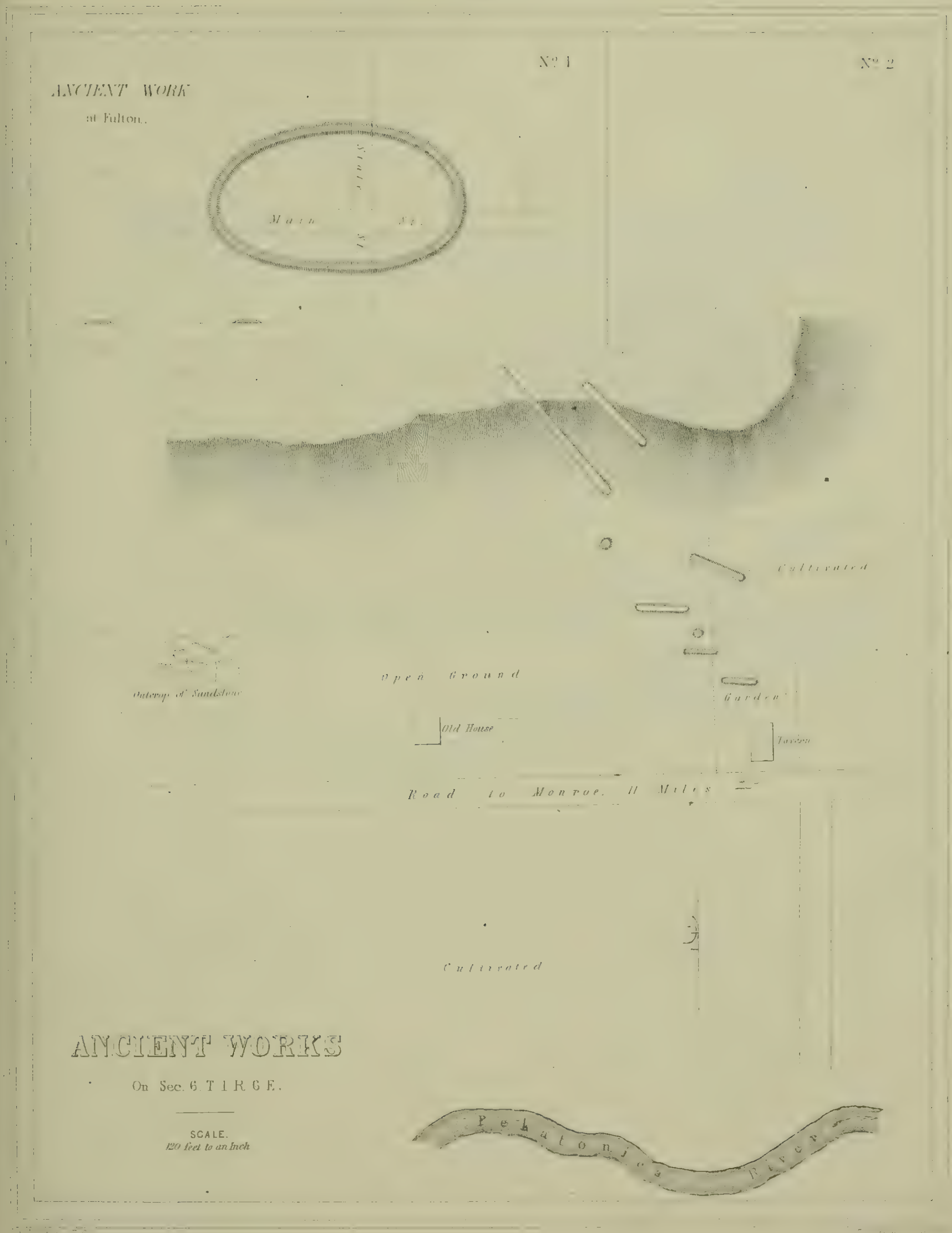
ANCIENT WORKS

ON THE SCHOOL SECTION

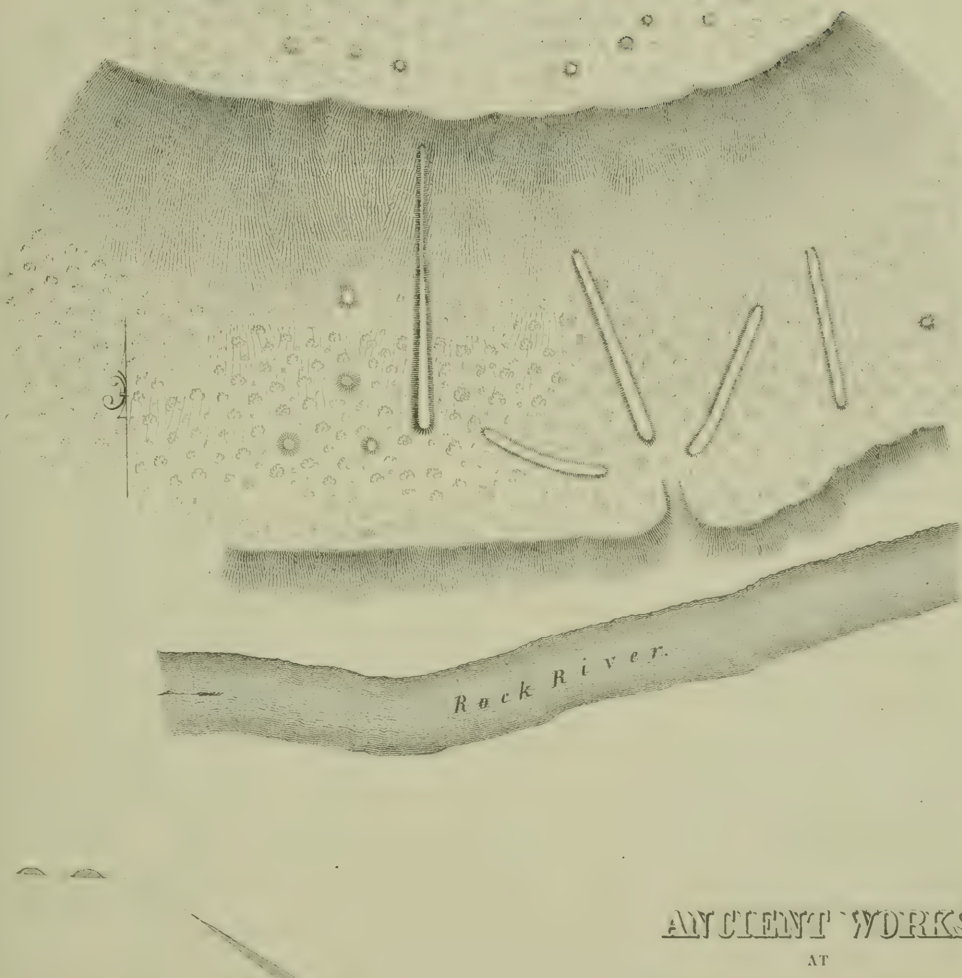
PEWAUKEE.

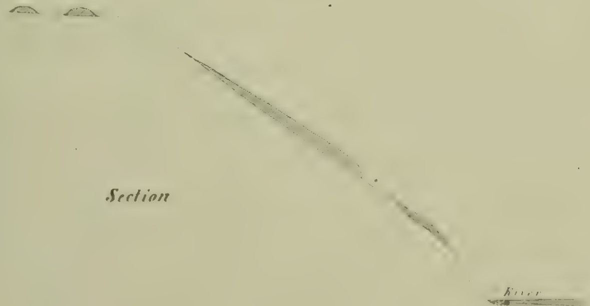
Surveyed May 1850, — by I. A. Lapham

SCALE
40 feet to an Inch



N° 1
N° 2
ANCIENT WORK
at Fulton.
State
Main St.
St.
Cultivated
Outcrop of Sandstone
Open Ground
Garden
Old House
Tavern
Road to Monroe. 11 Miles
Cultivated
ANCIENT WORKS
On Sec. 6. T 1 R. 6 E.
SCALE.
120 feet to an Inch
Pecatonica River





Section

ANCIENT WORKS

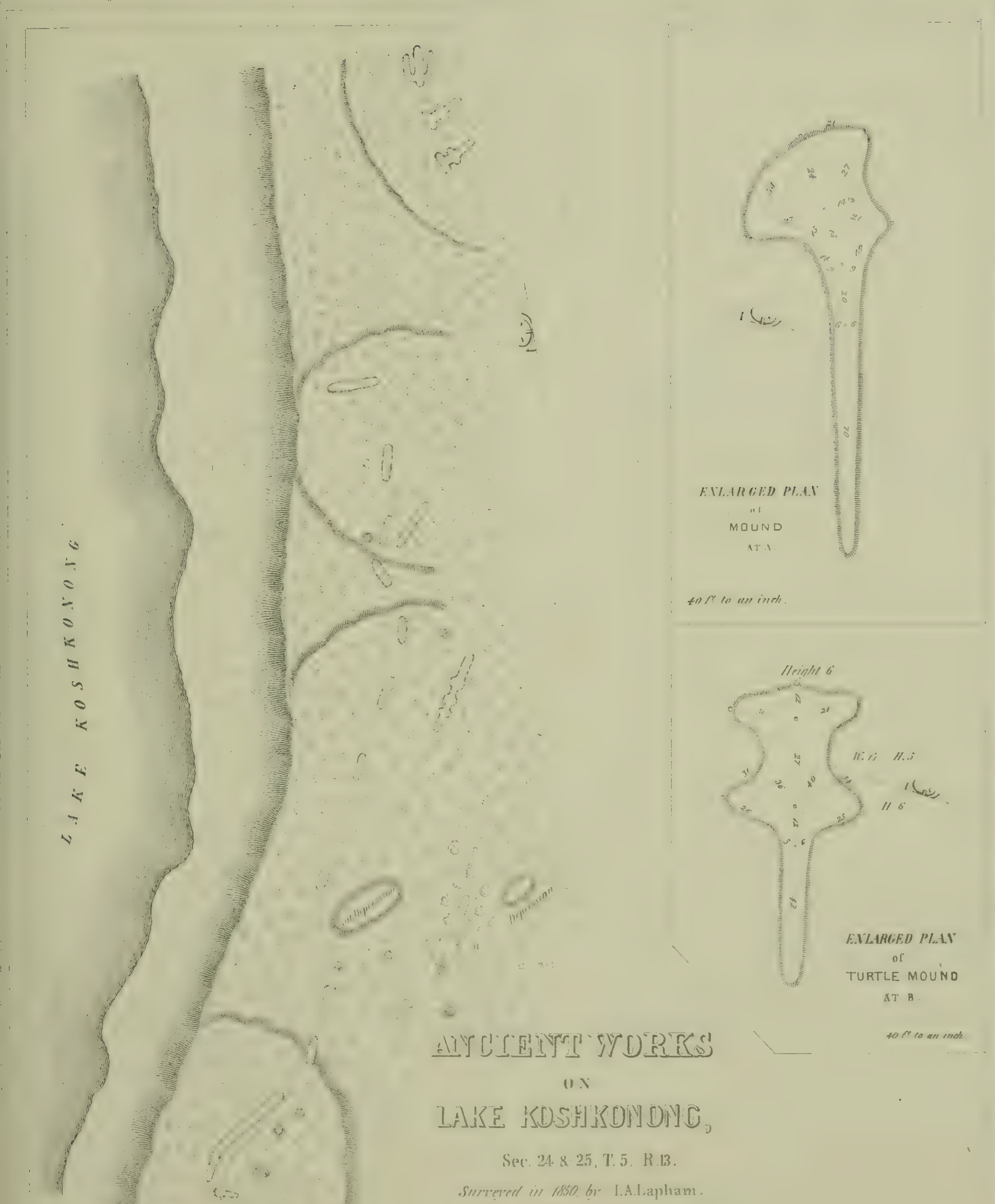
AT

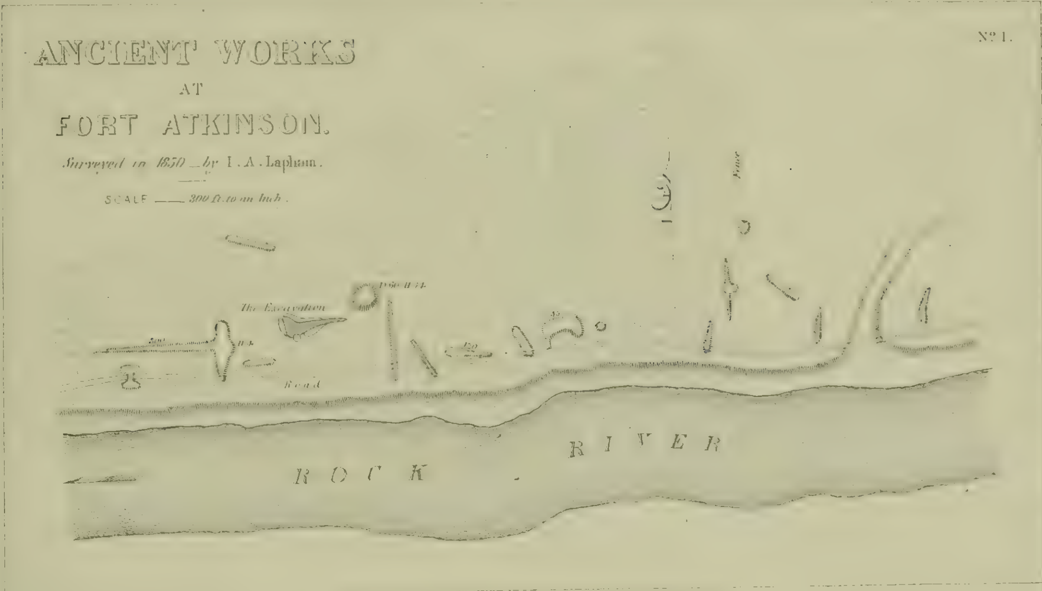
INDIAN HILL

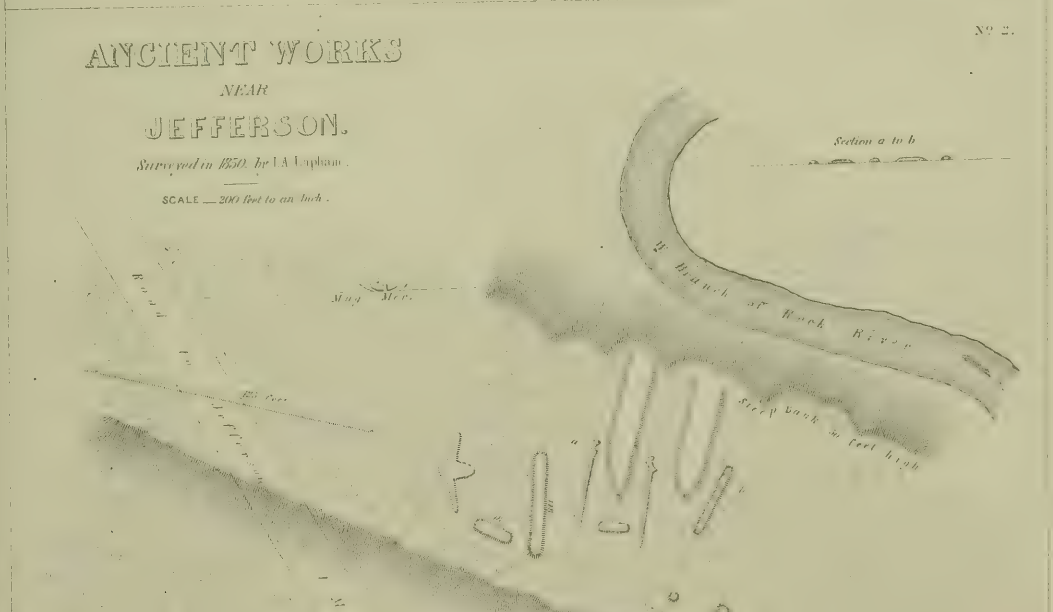
NEAR

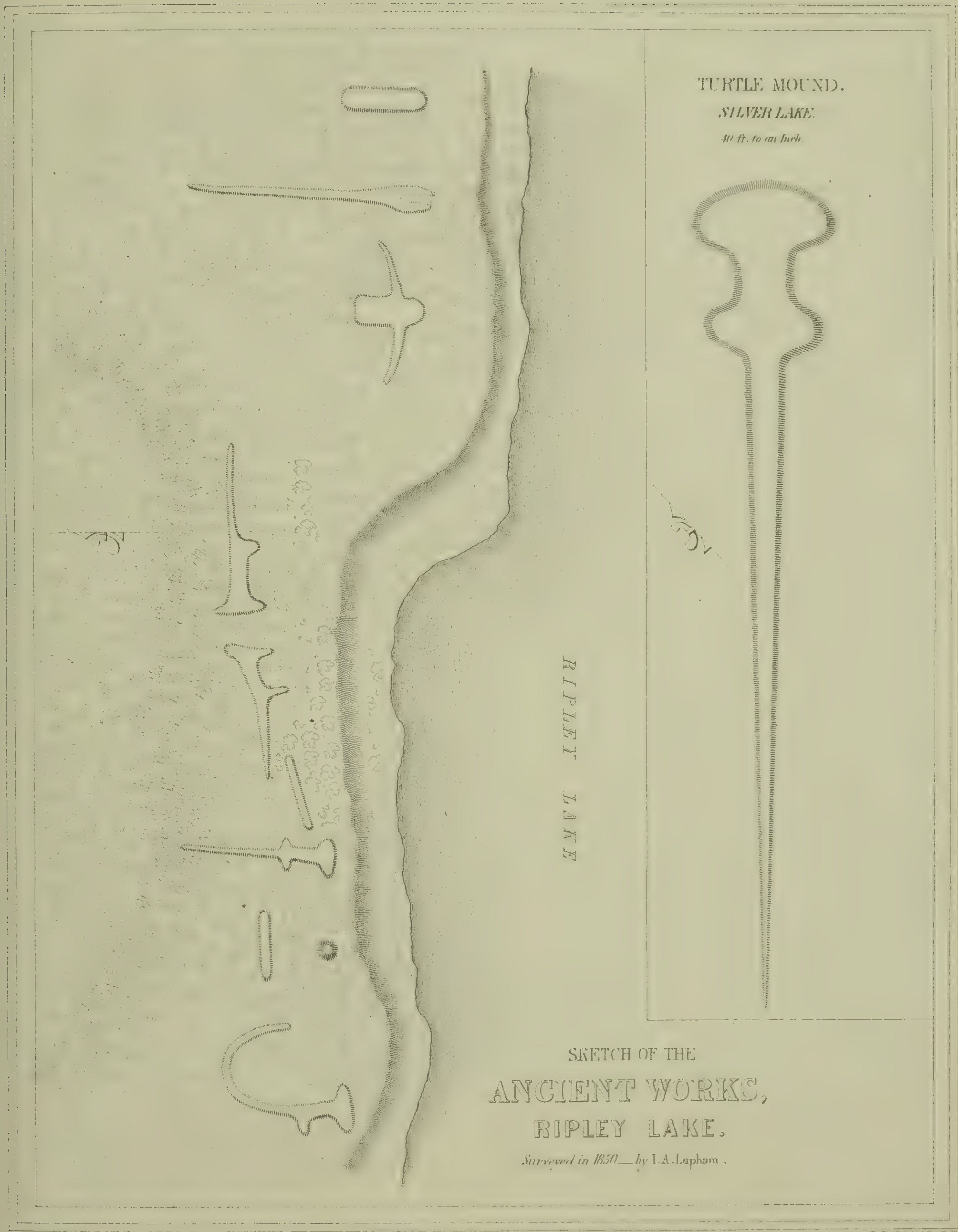
FULTON,

Surveyed in 1850, by — I. A. Lapham.

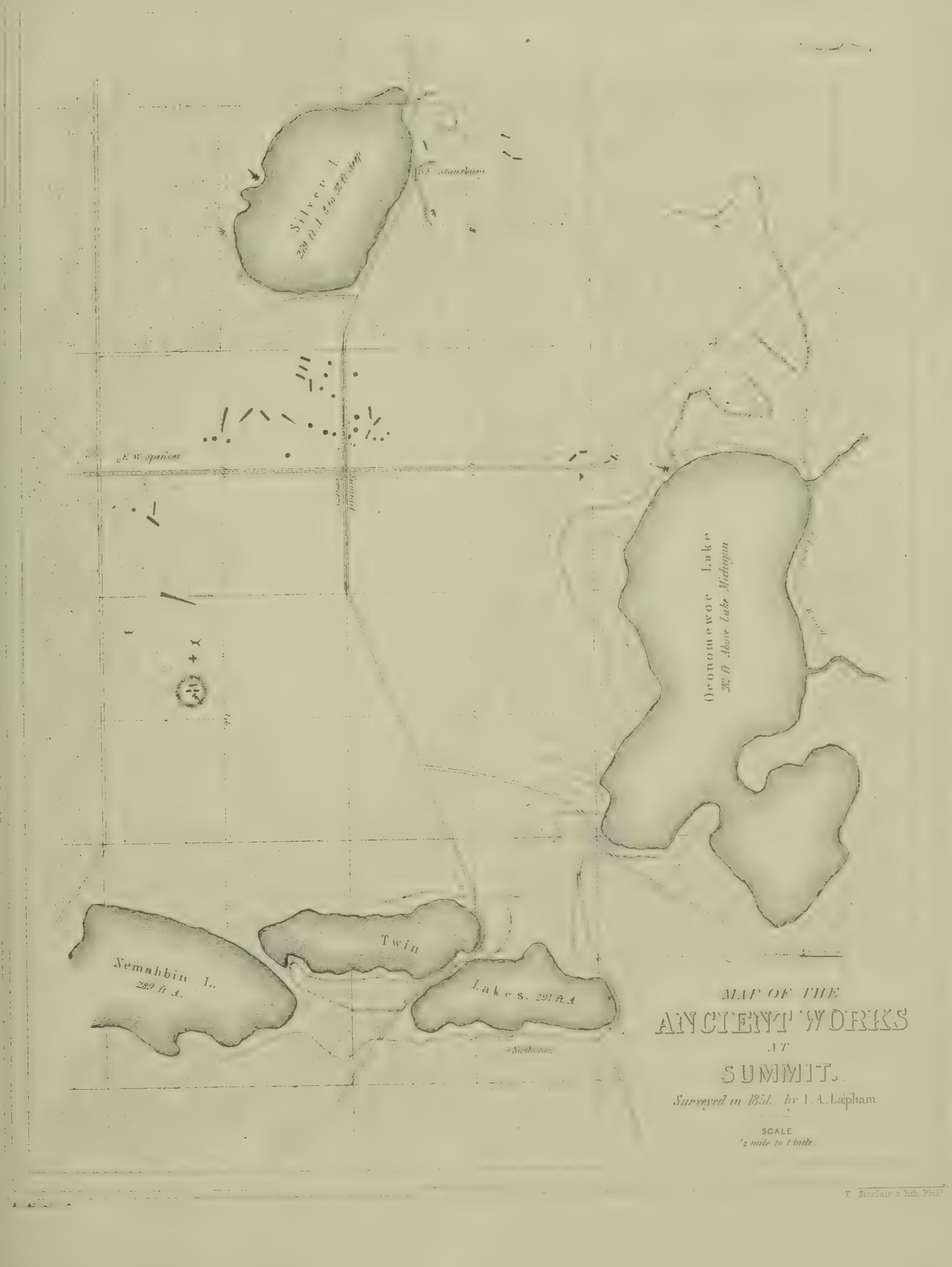

LAKE KOSHKONONG
ENLARGED PLAN
of
MOUND
AT A.
40 ft to an inch.
Height 6
H. 6 H. 5
H 6
ENLARGED PLAN
of
TURTLE MOUND
AT B.
40 ft to an inch.
ANCIENT WORKS
ON
LAKE KOSHKONONG,
Sec. 24 & 25, T. 5. R.13.
Surveyed in 1850, by I.A.Lapham.
SCALE
200 ft to an inch


No 1.
ANCIENT WORKS
AT
FORT ATKINSON.
Surveyed in 1850 _ by I. A. Lapham.
SCALE ___ 300 ft. to an inch.
The Excavation
Road
ROCK RIVER


No 2.
ANCIENT WORKS
NEAR
JEFFERSON.
Surveyed in 1850. by I. A. Lapham.
SCALE __ 200 feet to an inch.
Section a to b
Mag. Mer.
W. Branch of Rock River
Steep Bank 30 feet high

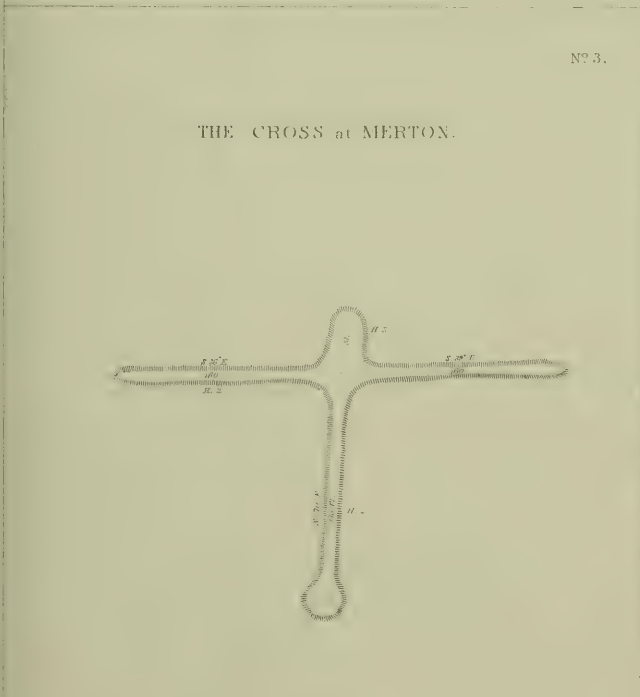


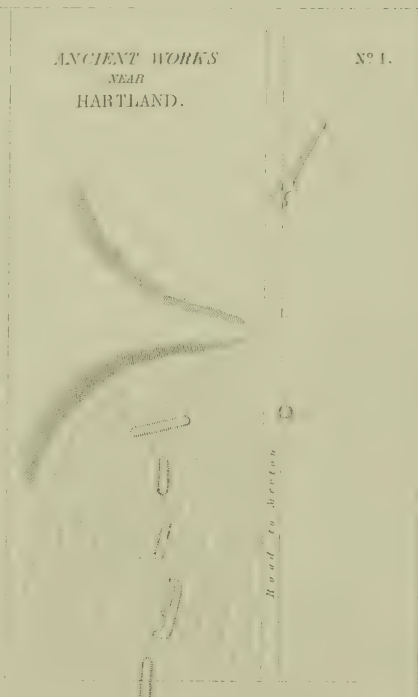
T. Sinclair's lith. Phil^a

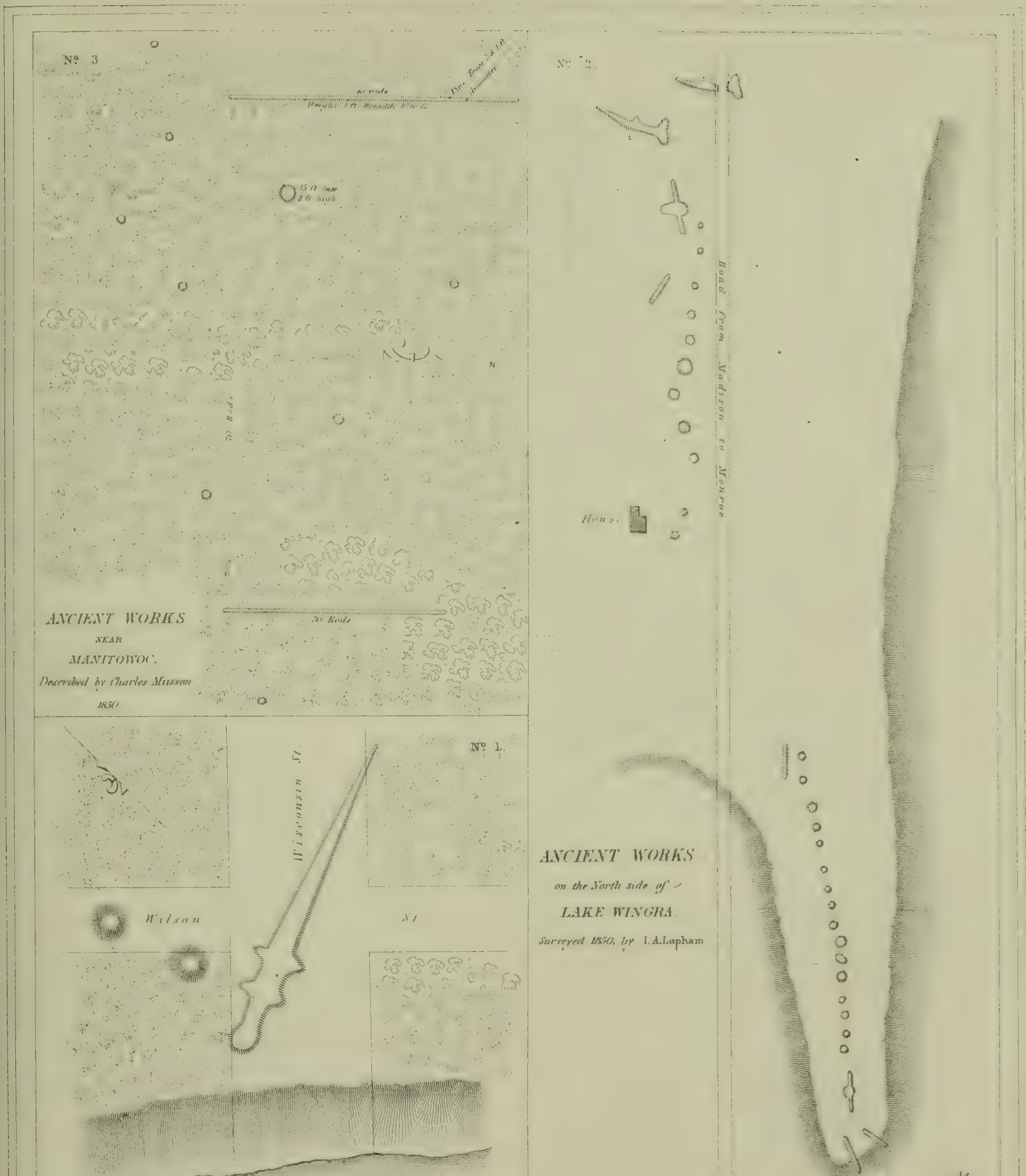


Silver L.
239 ft. A.
Oconomowoc Lake
Above Lake Michigan
Nemahbin L.
289 ft. A.
Twin
Lakes. 291 ft. A.
MAP OF THE
ANCIENT WORKS
AT
SUMMIT.
Surveyed in 1851 by I. A. Lapham
SCALE
½ mile to 1 inch.
T. Sinclair's lith. Phil.

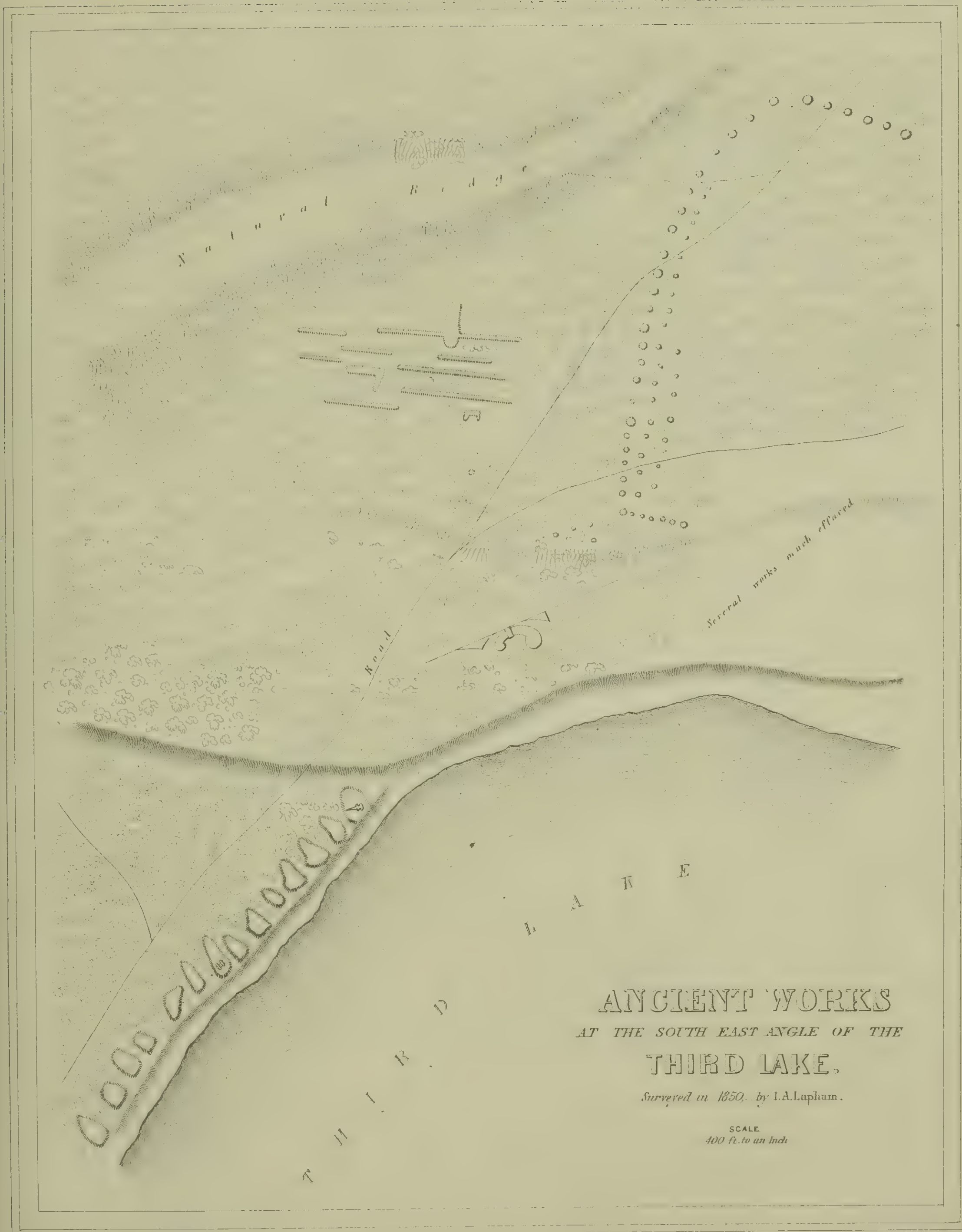

No. 2.
ANCIENT WORKS
—AT—
MERTON.
Surveyed in 1851_ by I.A. Lapham.
SCALE
1000 ft to an Inch.
Merton
Bark River
Mill
Fort Hill

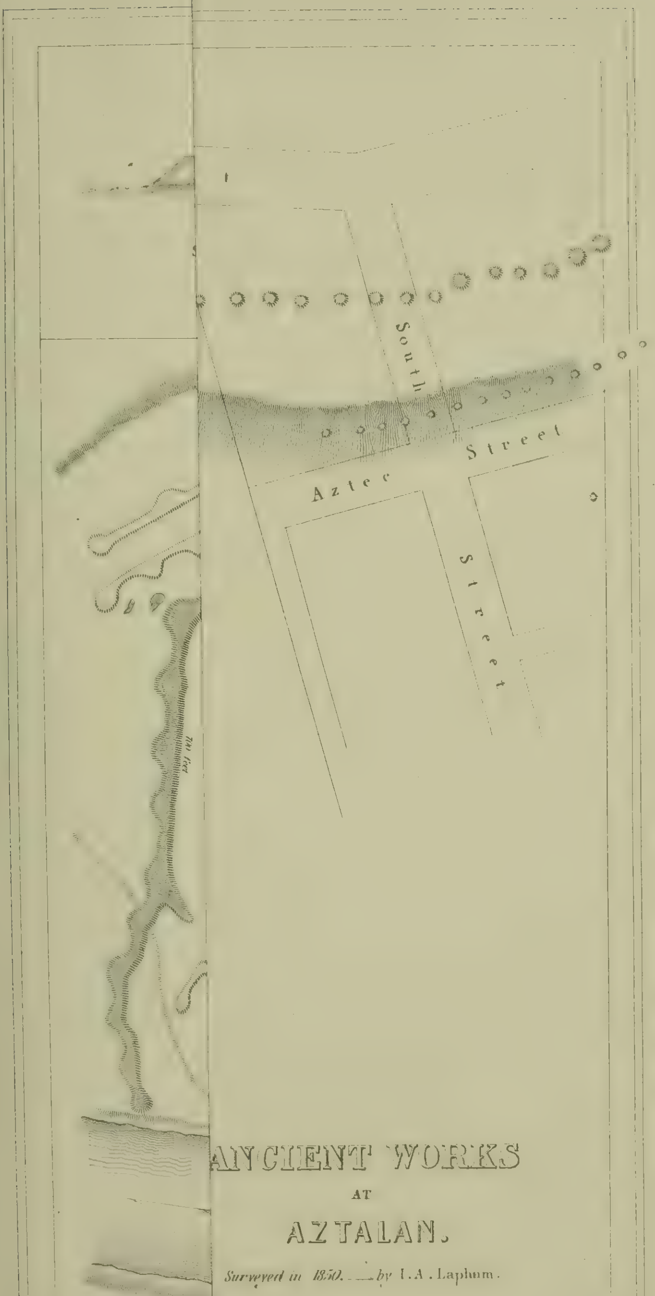

No. 3.
THE CROSS at MERTON.

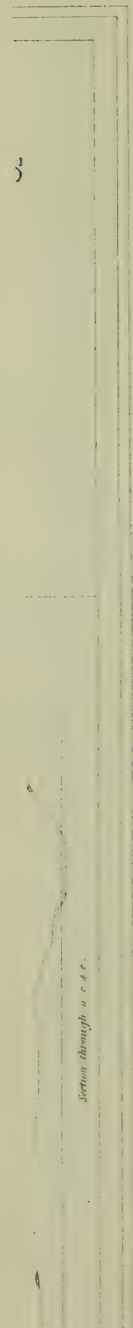

ANCIENT WORKS
NEAR
HARTLAND.
No. 1.
Road to Merton
Burial Ground

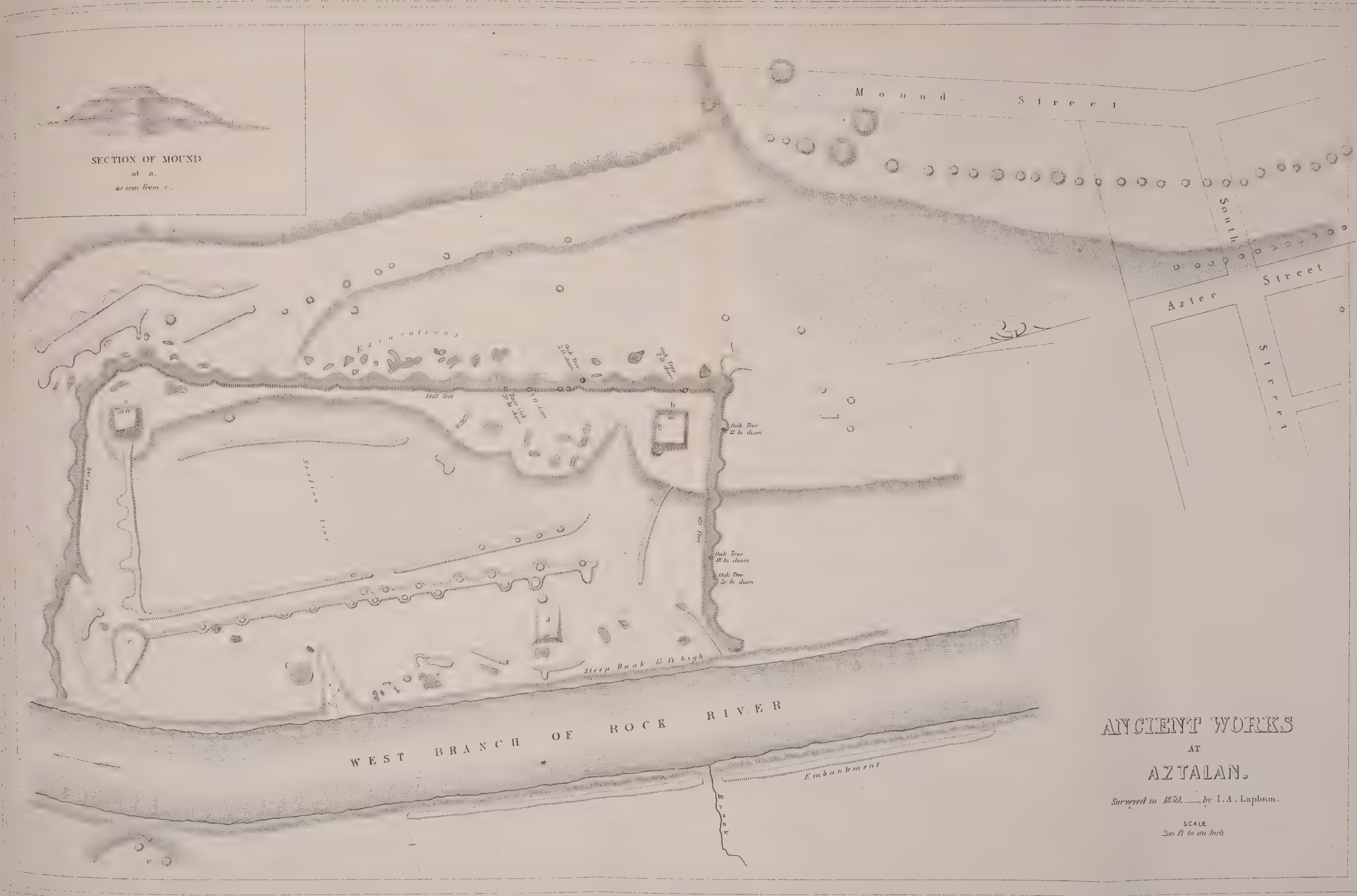


T Sinclair's lith, Phila


Natural Ridge
Road
Several works much effaced
THIRD LAKE
ANCIENT WORKS
AT THE SOUTH EAST ANGLE OF THE
THIRD LAKE.
Surveyed in 1850, by I. A. Lapham.
SCALE
400 ft. to an Inch

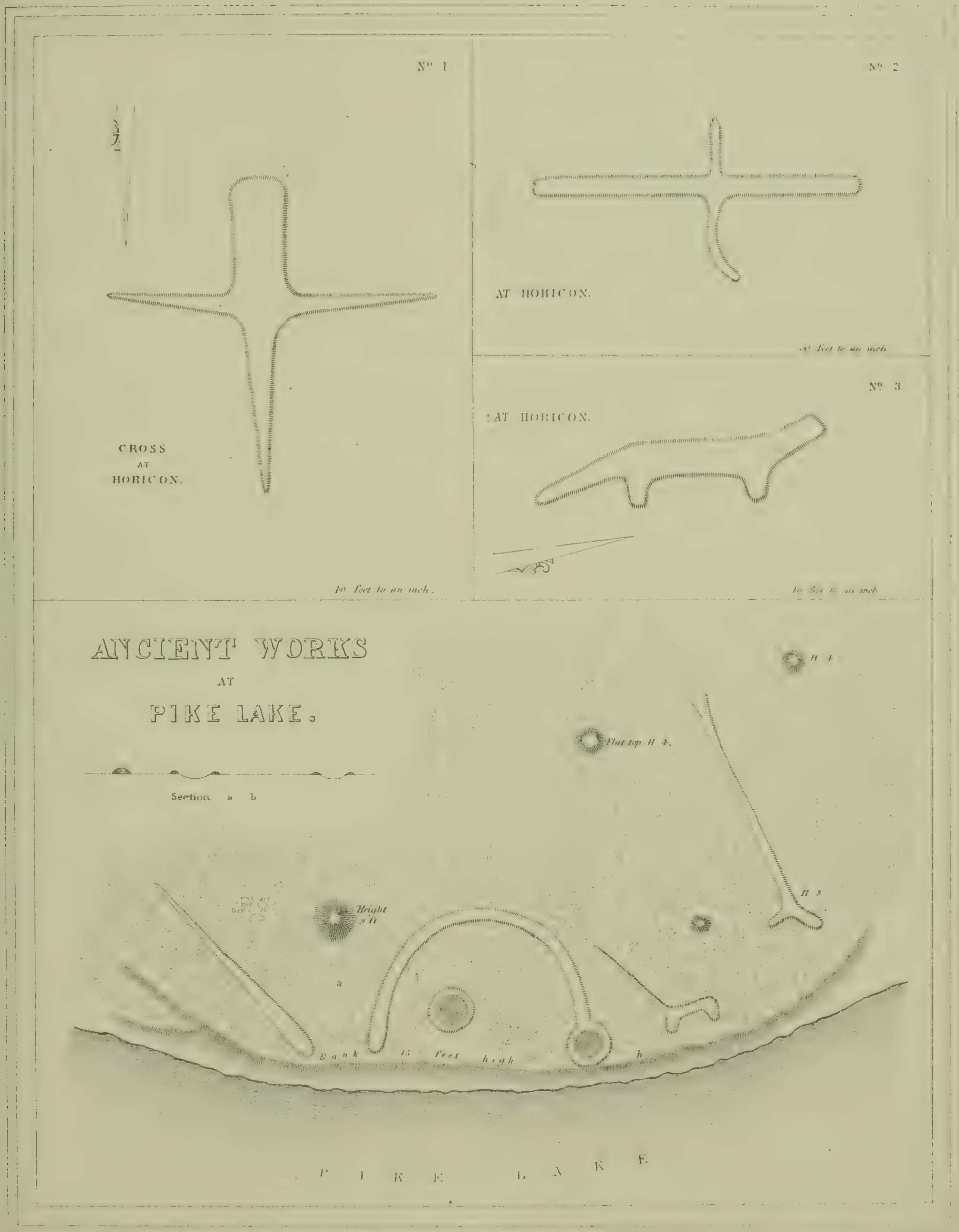

South
Aztec Street
Street
ANCIENT WORKS
AT
AZTALAN.
Surveyed in 1850. by I. A. Lapham.
SCALE
200 ft to an Inch
T Sinclair's lith Phil.


Section through a c d e.
Sinclair's lith Phil.


SECTION OF MOUND
at a.
as seen from c.
Mound Street
South Street
Aztec Street
Excavations
Oak Tree 12 In. diam.
Oak Tree 18 In. diam.
Steep Bank 15 ft high
WEST BRANCH OF ROCK RIVER
Embankment
Brook
ANCIENT WORKS
AT
AZTALAN.
Surveyed in 1850. — by I. A. Lapham.
SCALE
200 ft. to an Inch

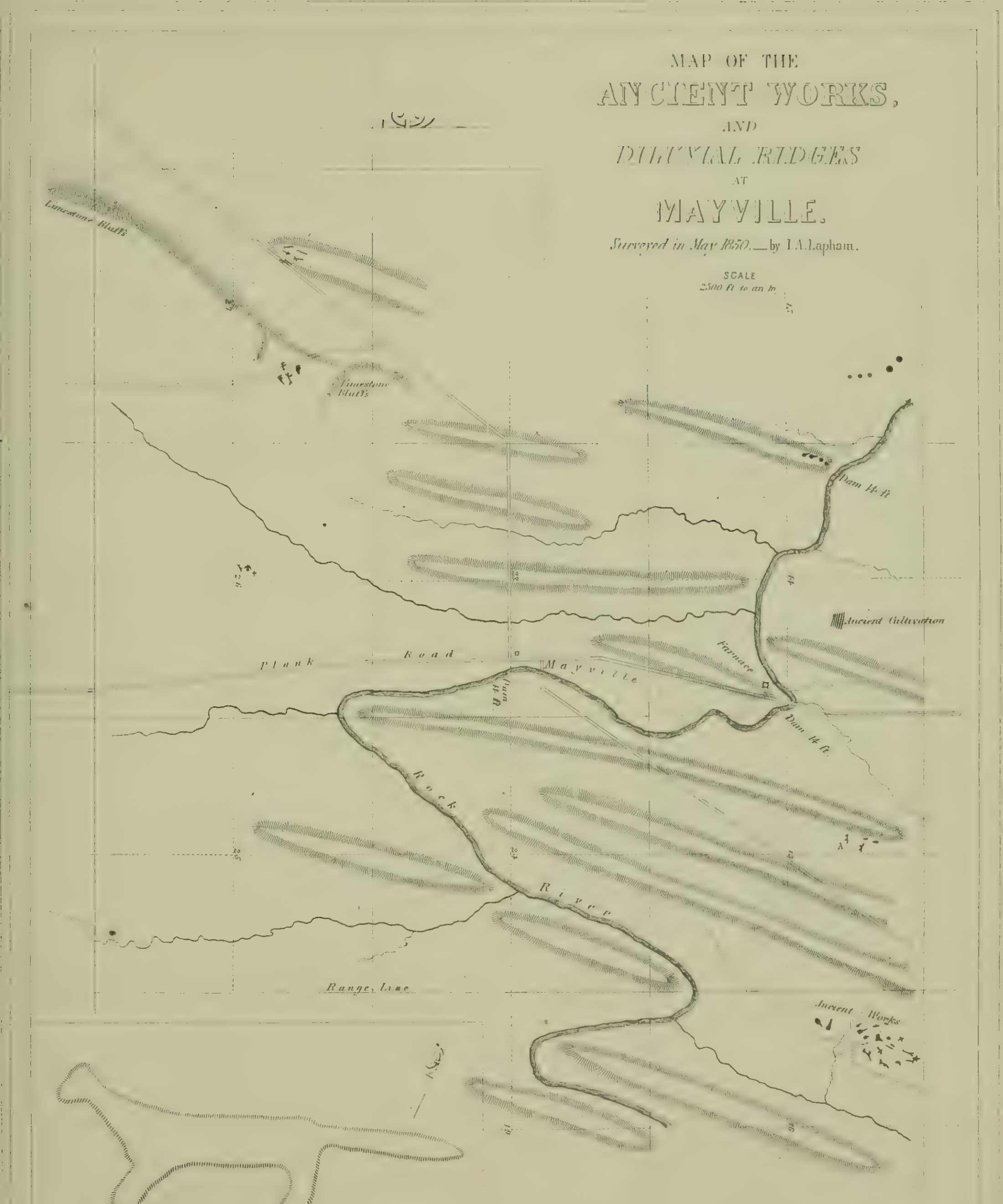
T. Sinclair's lith. Phila.

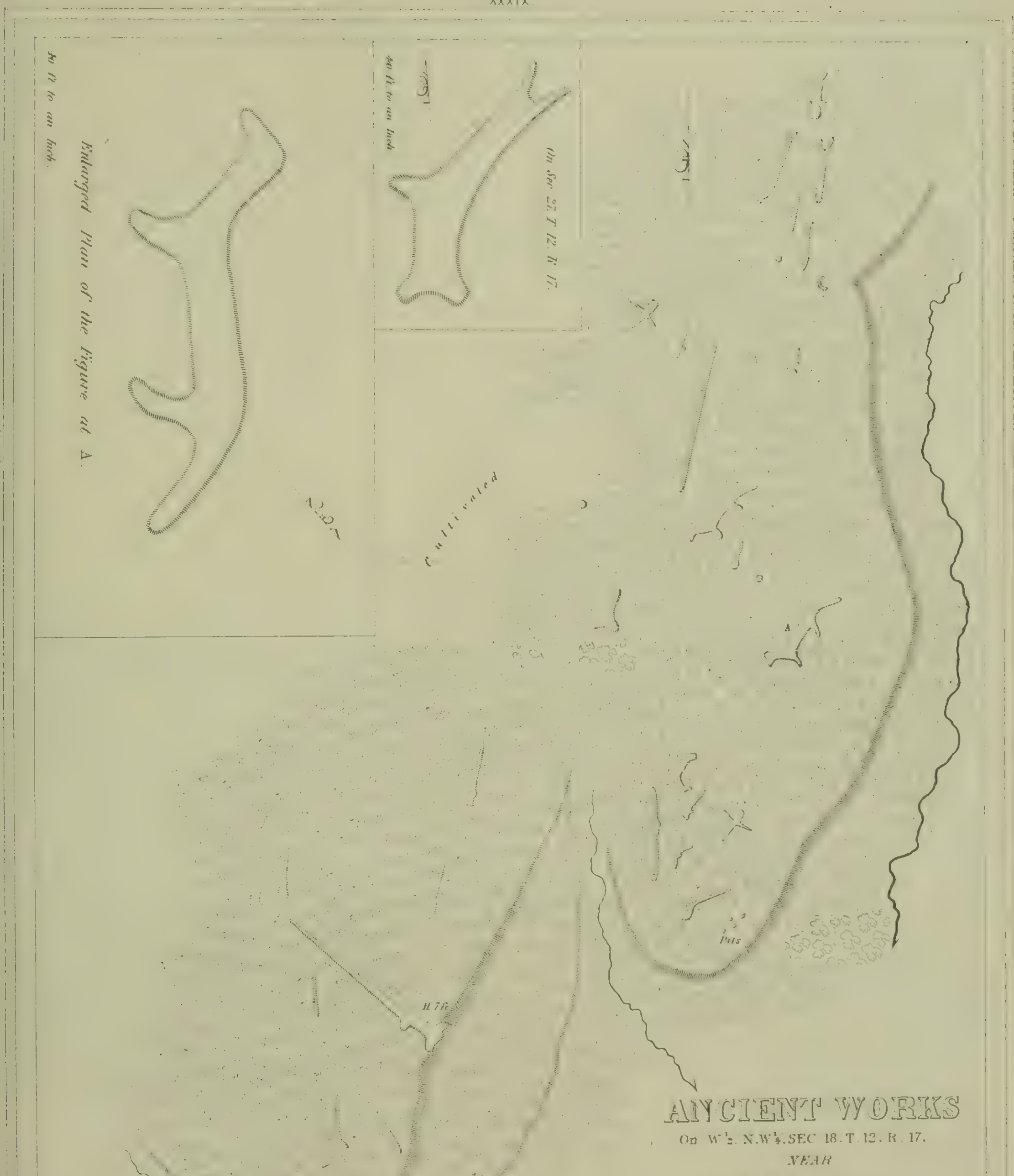
XXXVI.



Nº 1.
CROSS
AT
HORICON.
10 Feet to an inch.
Nº 2.
AT HORICON.
Nº 3.
AT HORICON.
10 Feet to an inch.
ANCIENT WORKS
AT
PIKE LAKE.
Section a .. b
H 4
Flat top H 4.
Height 9 ft
H 3
a
Bank 15 Feet high
b
PIKE LAKE

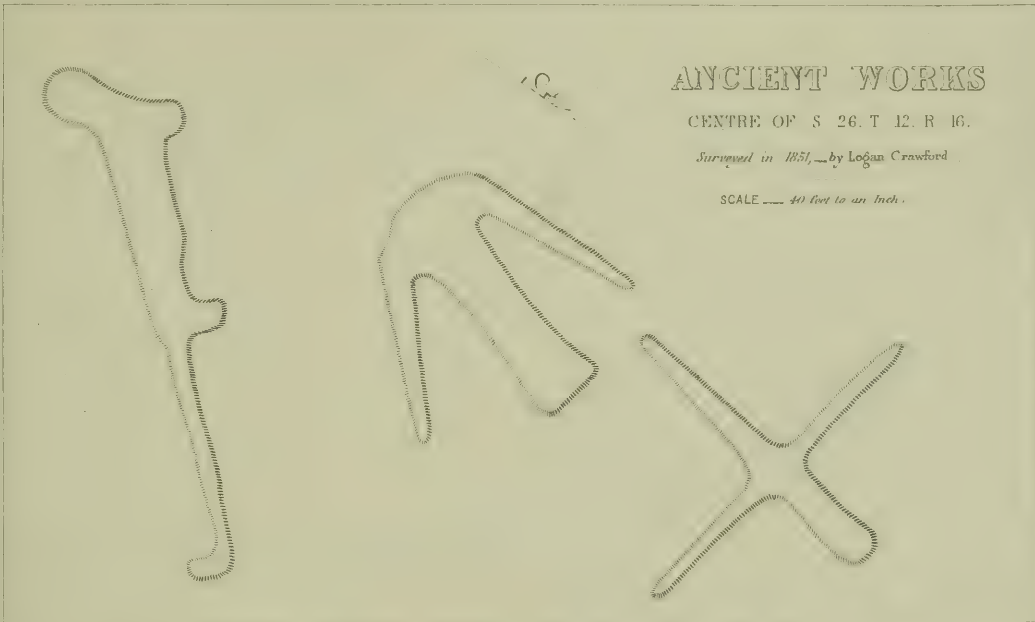
T. Sinclair's lith Phil^a

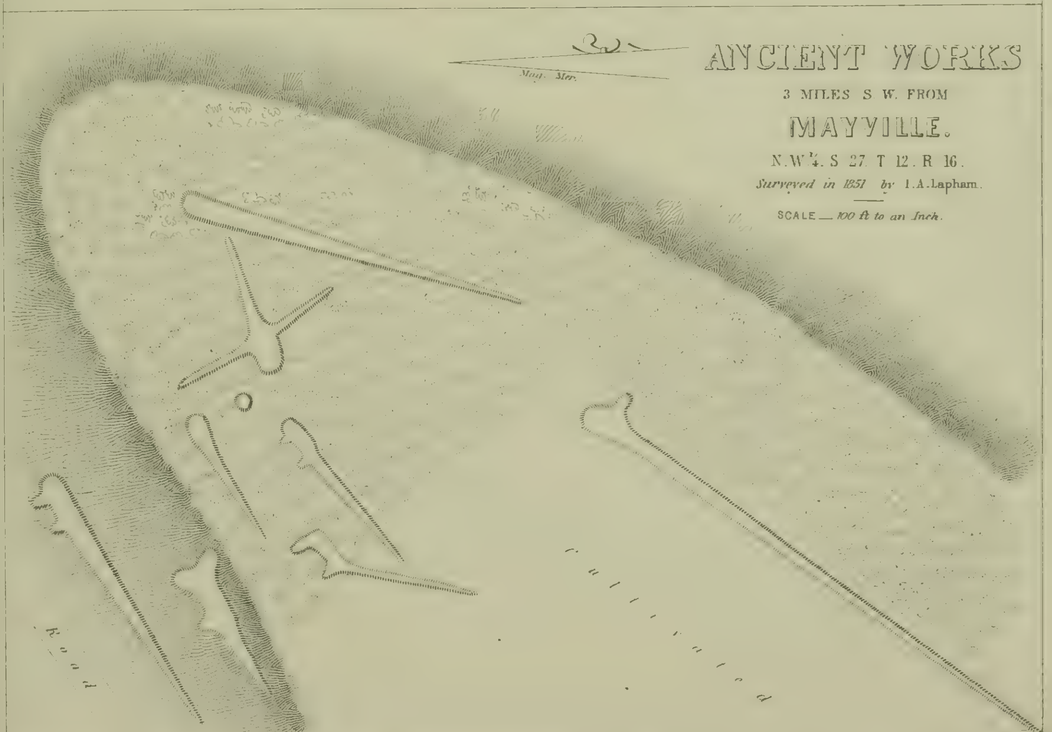

MAP OF THE
ANCIENT WORKS,
AND
DILUVIAL RIDGES
AT
MAYVILLE.
Surveyed in May 1850. — by I. A. Lapham.
SCALE
2500 ft. to an In.
Limestone Bluffs
Limestone Bluffs
Dam 14 ft.
Ancient Cultivation
Furnace
Plank Road
Mayville
Dam 14 ft.
Dam 14 ft.
Rock River
Range Line
Ancient Works
Enlarged Plan of a figure at A. — Surveyed by L. Crawford.
10 feet to an inch



ANCIENT WORKS
On W½. N.W¼. SEC 18. T. 12. R. 17.
NEAR
MAYVILLE.
Surveyed in 1851, by I.A. Lapham.
SCALE – 200 ft. to an inch.

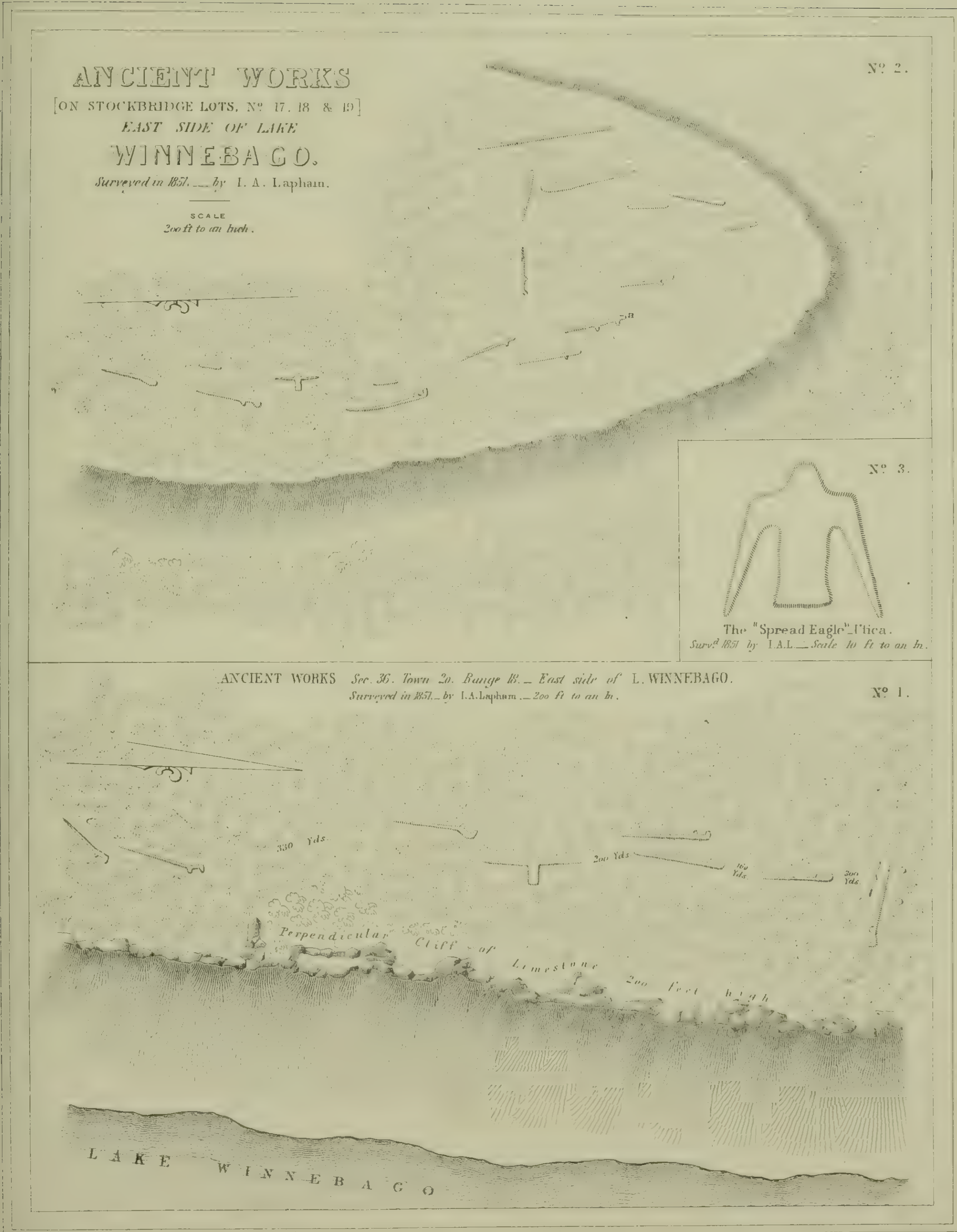
T. Sinclair's lith. Phila





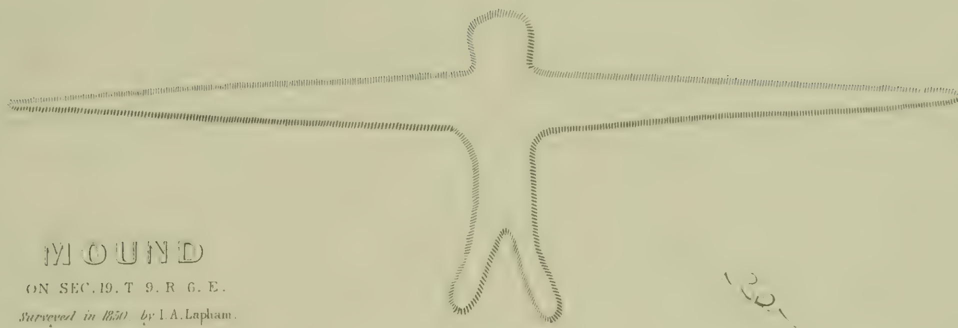
I. A. Lapham Del.

T. Sinclair's lith. Phil^a



T. Sinclair's lith. Phila

Nº 4.



MOUND

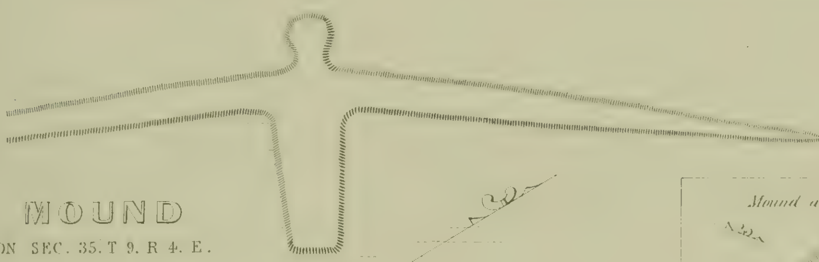
ON SEC. 19. T 9. R 6. E.

Surveyed in 1850 by I. A. Lapham.

SCALE

40 ft to an Inch

Nº 3.



MOUND

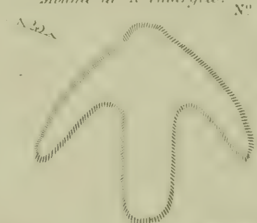
ON SEC. 35. T 9. R 4. E.

Surveyed in 1850, by I. A. Lapham.

SCALE

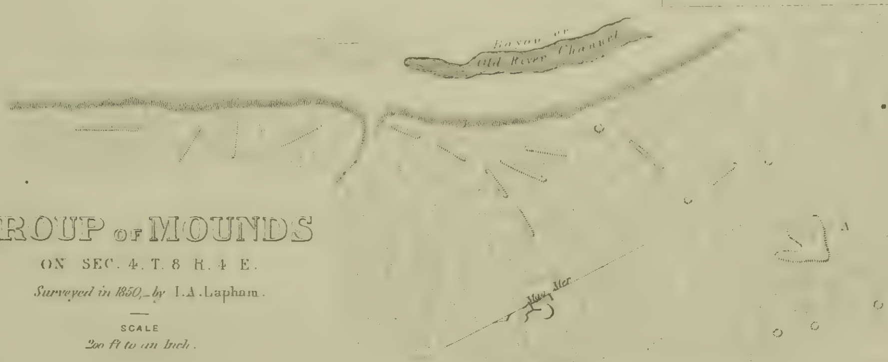
40 ft. to an Inch.

Mound at A enlarged. Nº 2.



40 ft. to an in.

Nº 1.



GROUP OF MOUNDS

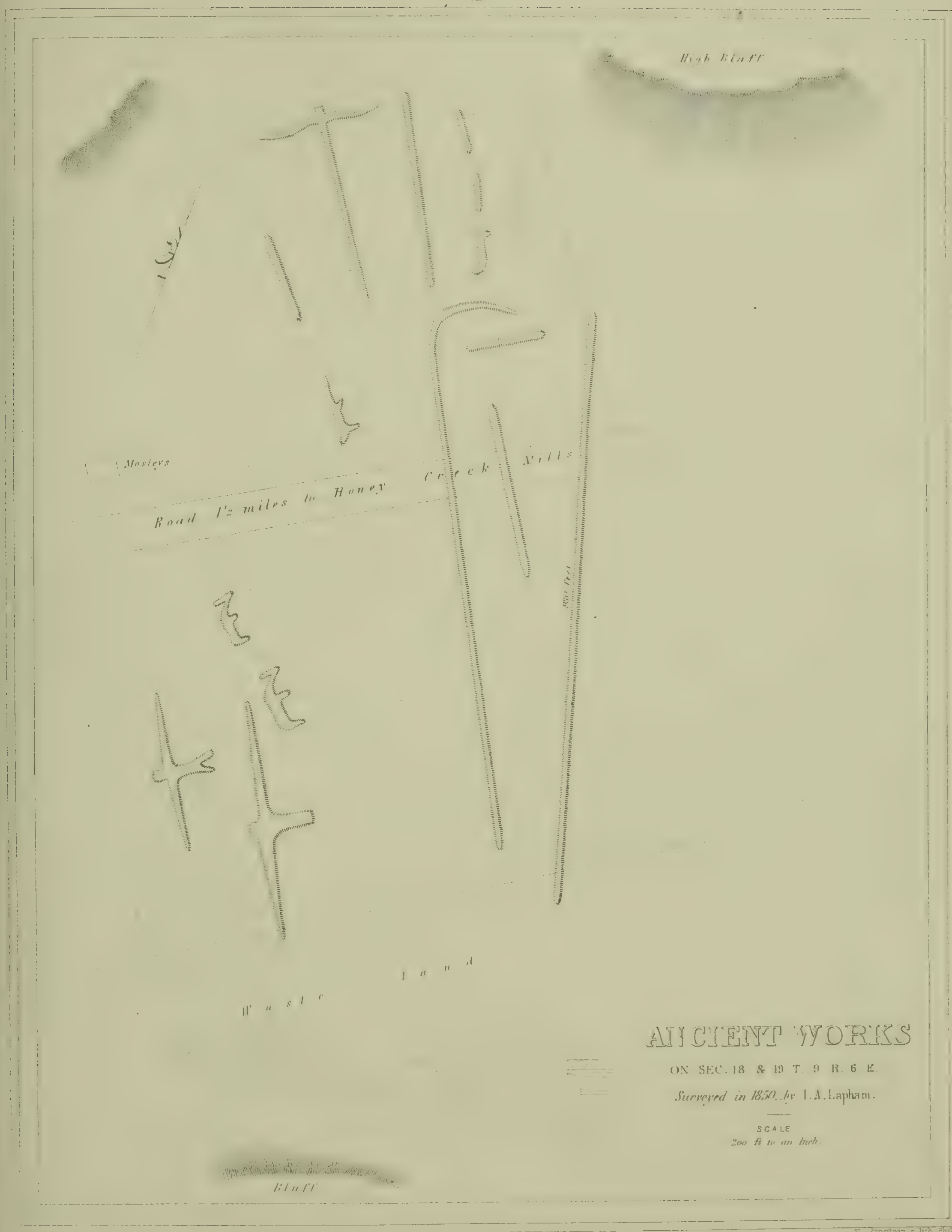
ON SEC. 4. T. 8 R. 4 E.

Surveyed in 1850, by I. A. Lapham.

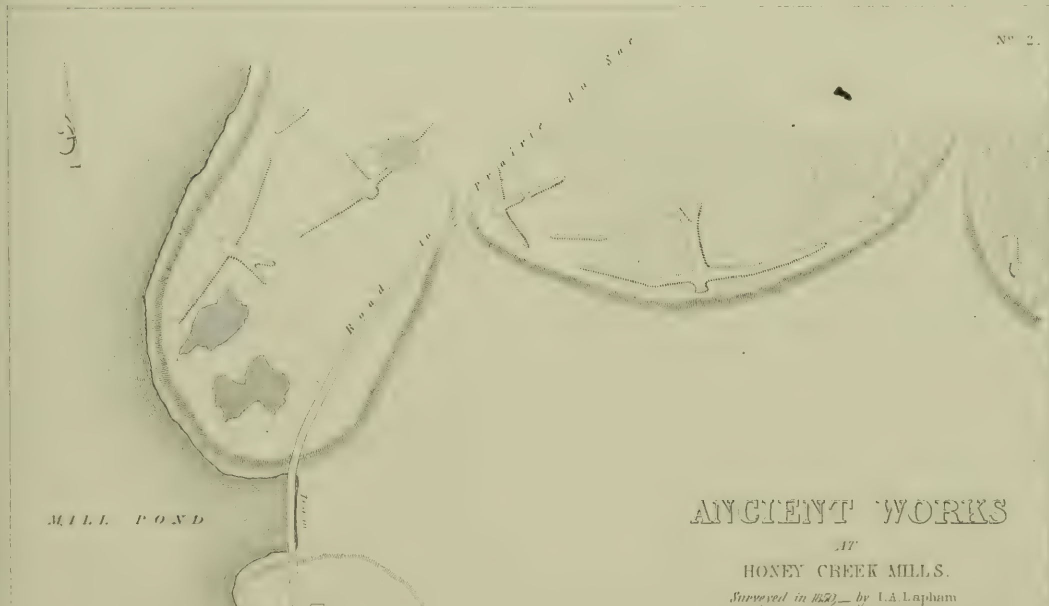
SCALE

200 ft to an Inch.

T. Sinclair's lith. Phila.



T. Sinclair's lith. Phila



T. Sinclair's lith. Phil.

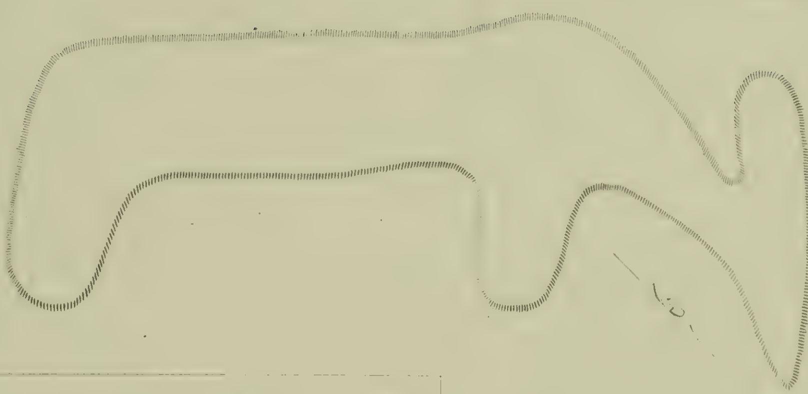
No 1.

THE BUFFALO

On Sec. 19 T. 9 R. 6.

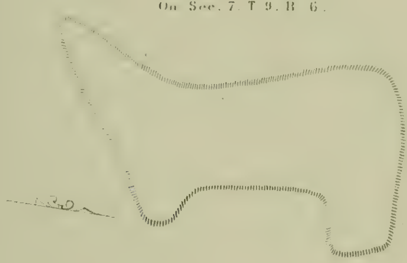
Surveyed in 1850 — by I. A. Lapham.

20 ft to an inch.



On Sec. 7. T. 9. R. 6.

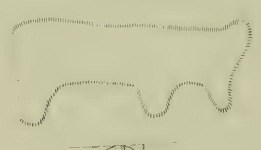
No 2.



20 ft. to an inch.

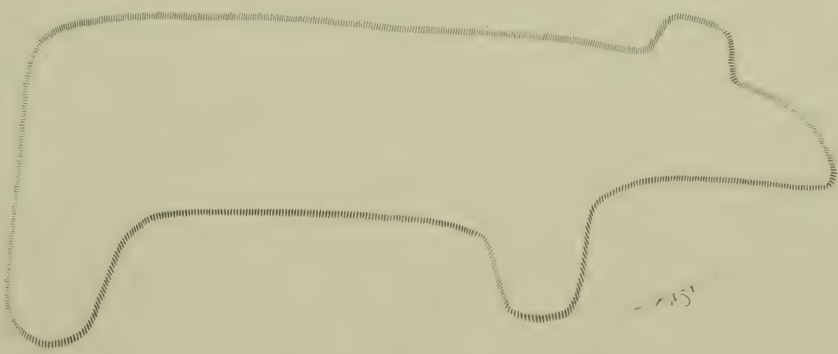
On Sec. 7. T. 9. R. 6.

No 3.



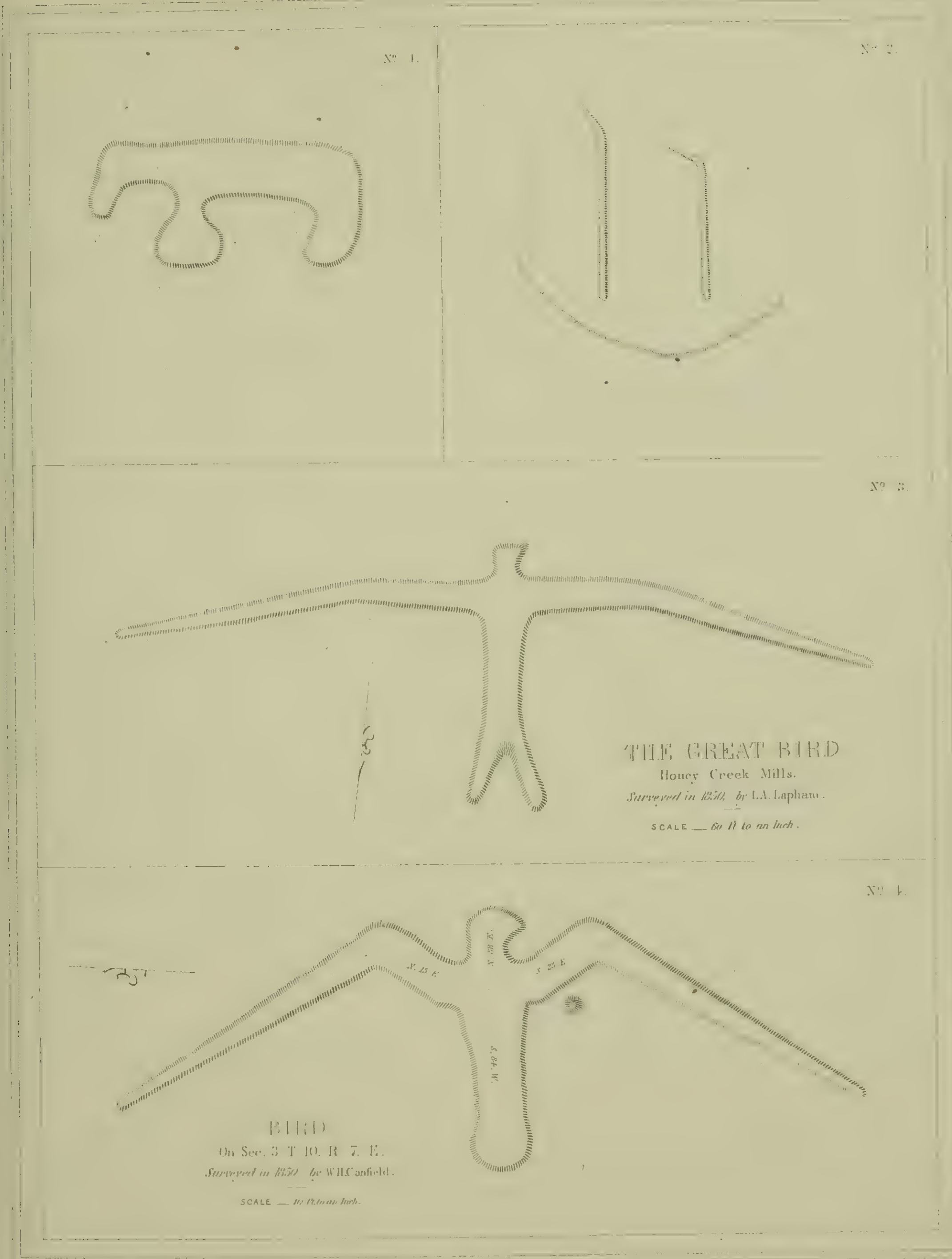
40 ft. to an inch.

No 4.

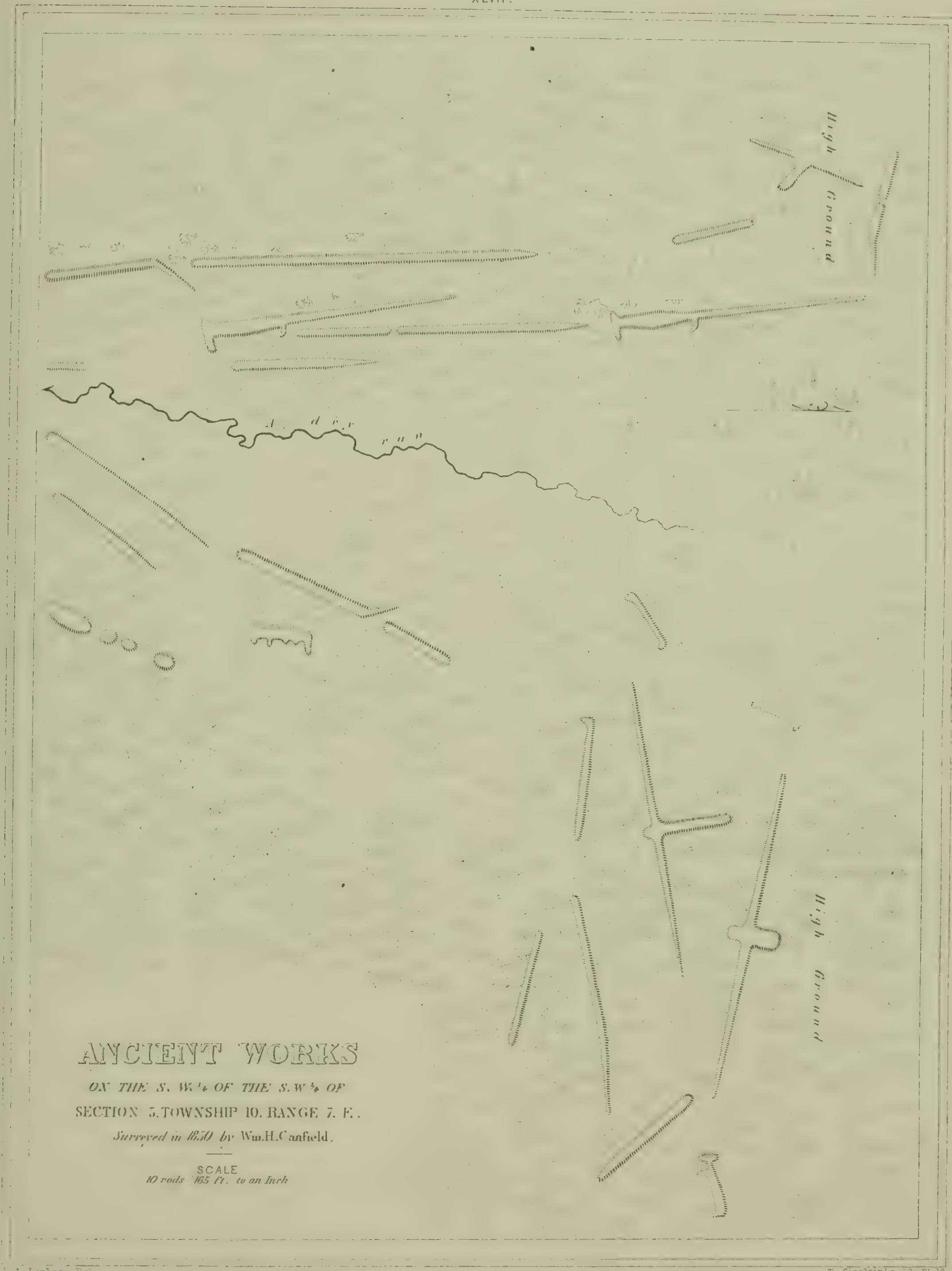


20 ft. to an inch.

T. Sinclair's lith. Phil.



T. Sinclair's lith Phila



ANCIENT WORKS

ON THE S. W. ¼ OF THE S. W ¼ OF

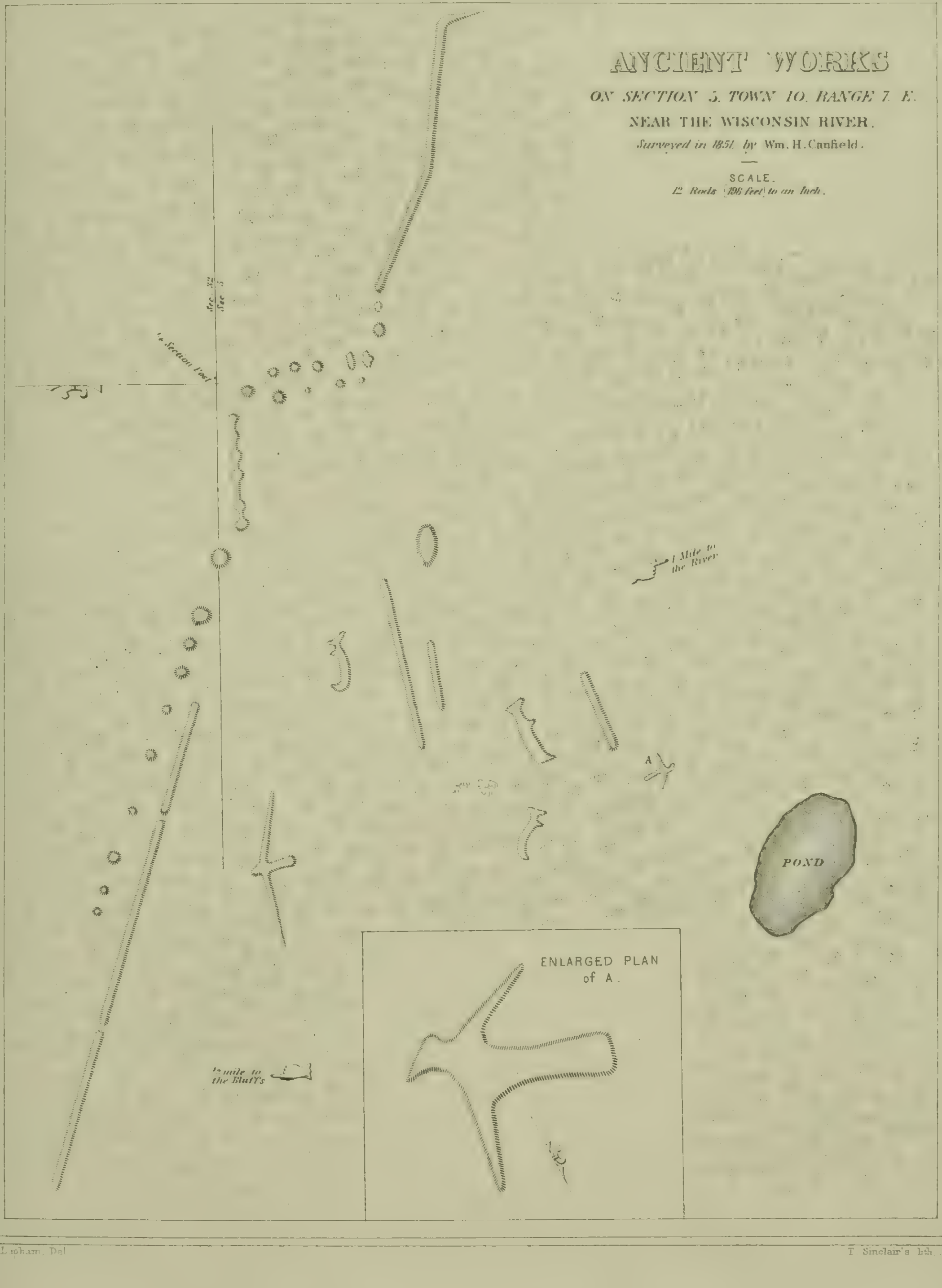
SECTION 5. TOWNSHIP 10. RANGE 7. E.

Surveyed in 1850 by Wm. H. Canfield.

SCALE

10 rods 165 Ft. to an Inch

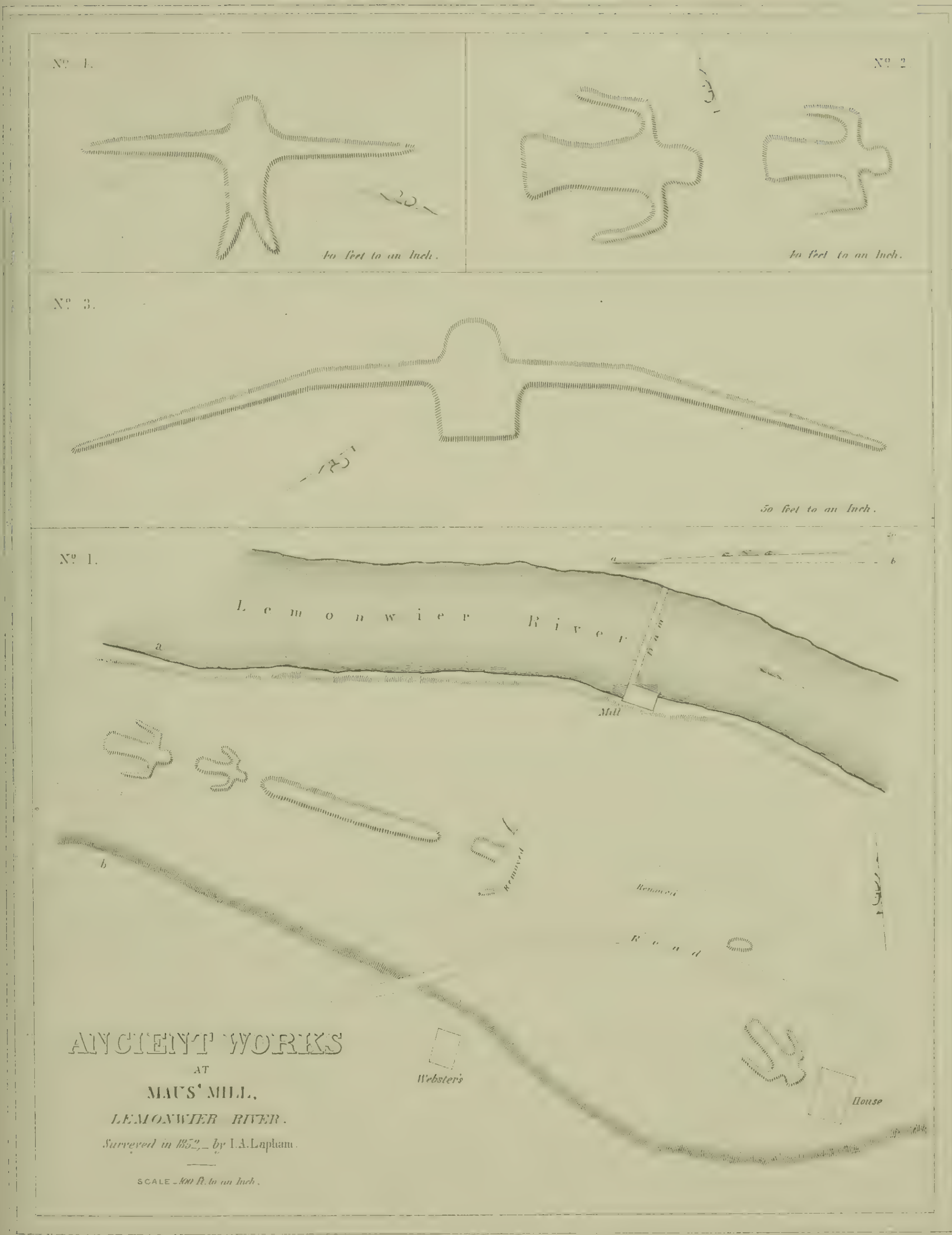
I. A. Lapham Del. T. Sinclair's lith Phila



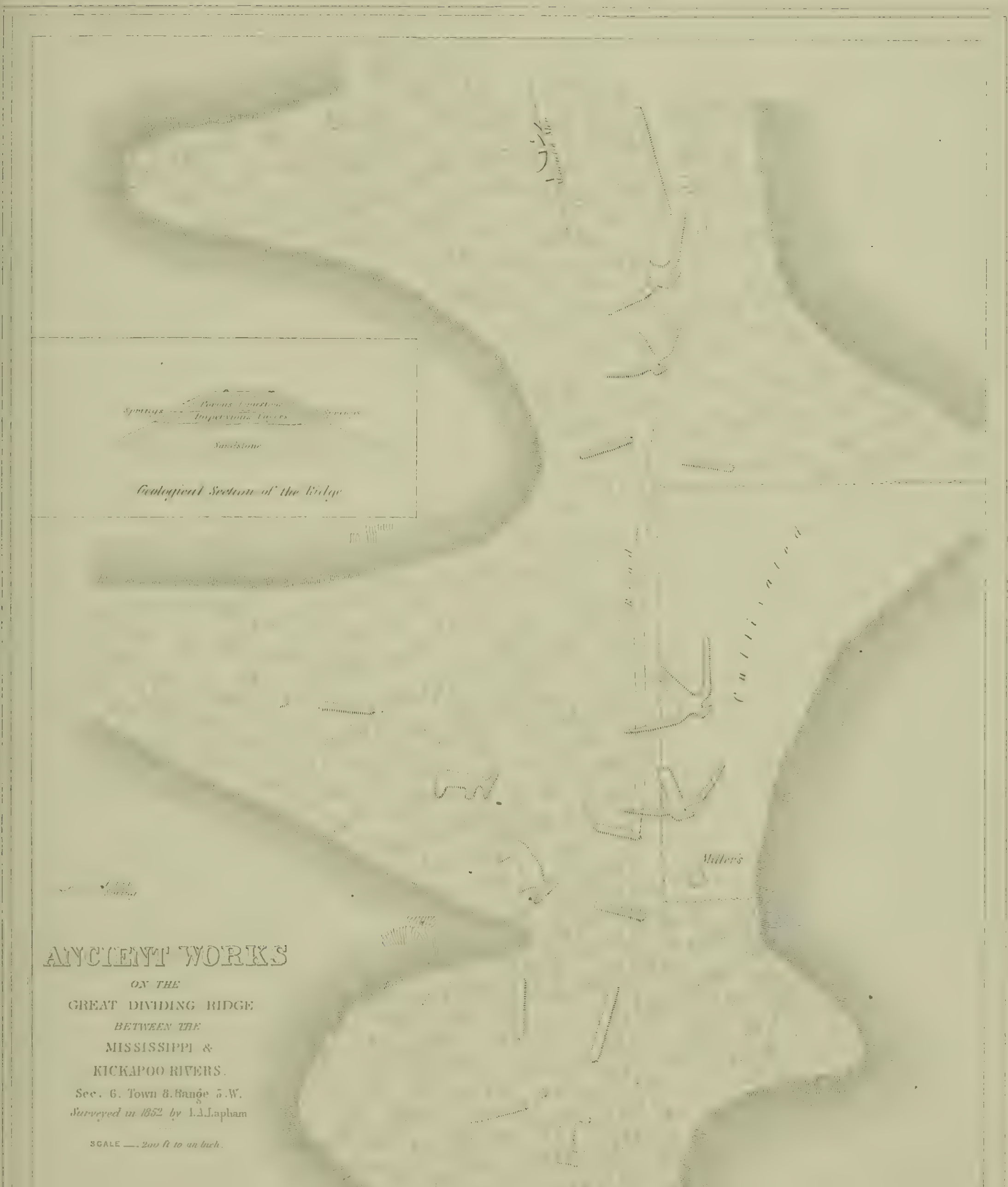
I. A. Lapham, Del. T. Sinclair's lith. Phil^a

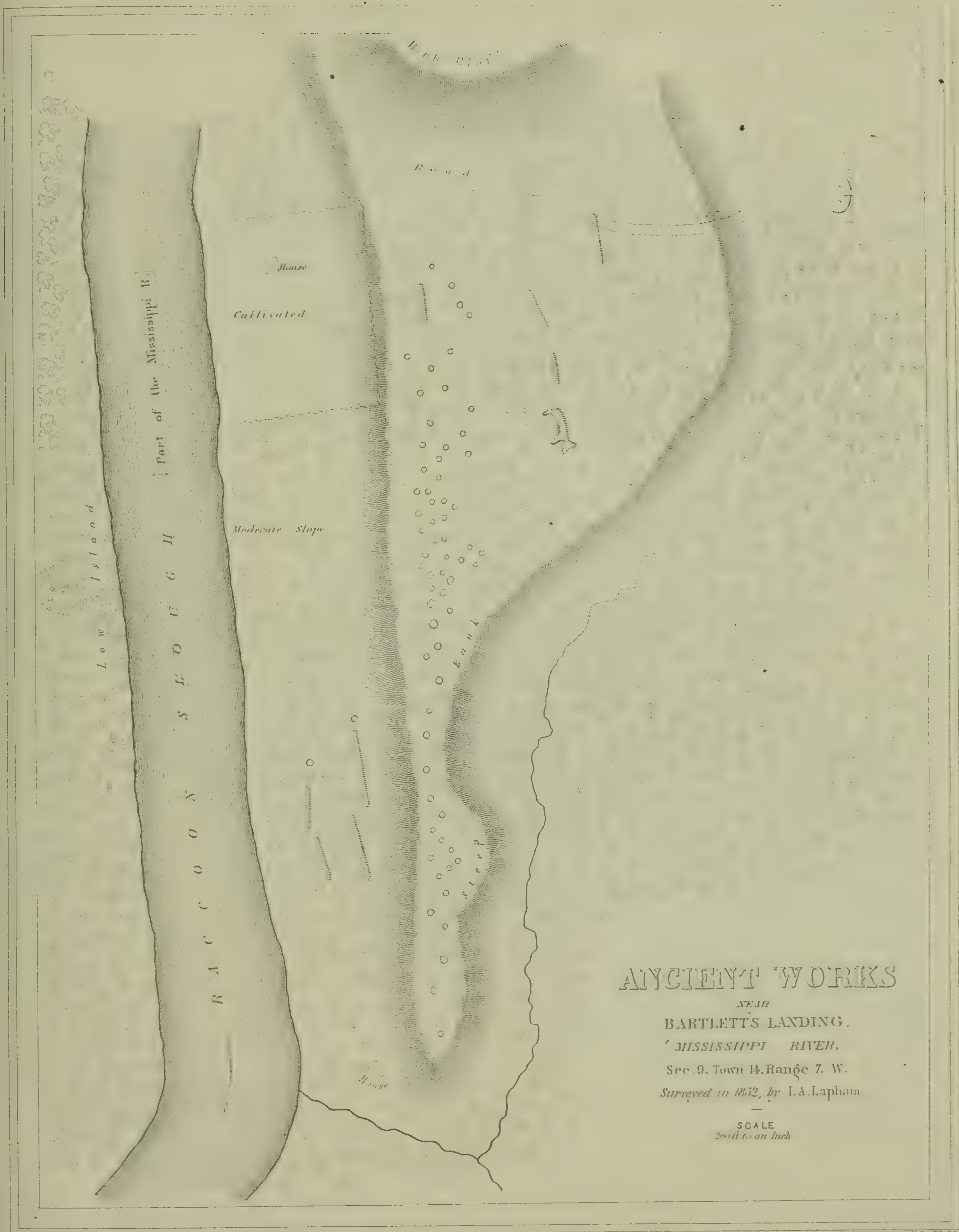

ANCIENT WORKS
ONE MILE CREEK,
ADAMS COUNTY.
Surveyed in 1852, by I. A. Lapham.
SCALE
100 ft. to an inch.
Road
Sandy Ridge
Road
Sandy Ridge
Section across the ridges.

L.

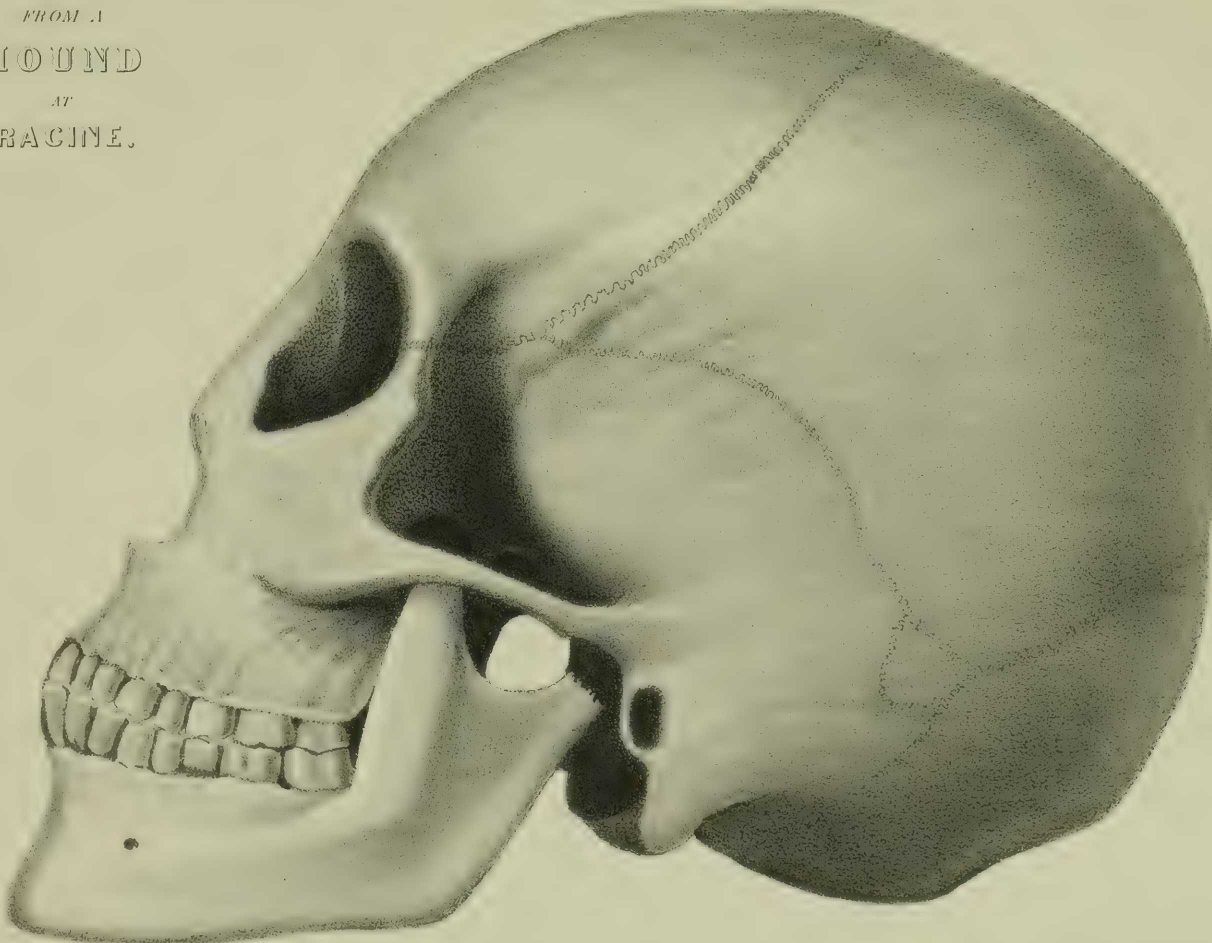


T. Sinclair's lith


Springs
Porous Limestone
Impervious Layers
Springs
Sandstone
Geological Section of the Ridge
Cultivated
Millers
ANCIENT WORKS
ON THE
GREAT DIVIDING RIDGE
BETWEEN THE
MISSISSIPPI &
KICKAPOO RIVERS.
Sec. 6. Town 8. Range 5. W.
Surveyed in 1852 by I. A. Lapham
SCALE — 200 ft to an Inch.


Road
House
Cultivated
Part of the Mississippi R.
Moderate Slope
Low Island
RACCOON SLOUGH
Bank
Steep
House
ANCIENT WORKS
NEAR
BARTLETTS LANDING,
MISSISSIPPI RIVER.
Sec. 9. Town 14. Range 7. W.
Surveyed in 1852, by I. A. Lapham.
SCALE

FROM A
MOUND
AT
RACINE.




Gate
ANCIENT WORKS
ON THE
COLLEGE GROUNDS.
BELOIT.
Surveyed in 1852 _ by Prof. S. P. Lathrop.
SCALE
80 ft to an inch.
Beloit
College
Building
Road

T. Sinclair's lith. Phila.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

A MEMOIR

ON THE

EXTINCT SLOTH TRIBE

OF

NORTH AMERICA.

BY

JOSEPH LEIDY, M. D.,

PROFESSOR OF ANATOMY IN THE UNIVERSITY OF PENNSYLVANIA, AND CURATOR OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

[ACCEPTED FOR PUBLICATION, DECEMBER, 1853.]

COMMISSION

TO WHICH THIS PAPER HAS BEEN REFERRED.

Isaac Hays, M. D.
Prof. W. E. Horner.

Joseph Henry,
Secretary S. I.

T. K. AND P. G. COLLINS, PRINTERS,
PHILADELPHIA.

INTRODUCTION.

Among the most remarkable of all extinct mammalia are the gigantic sloths, which inhabited the western continent during the pleistocene, or drift period, contemporaneously with the better known Elephant and Mastodon.

The remains of the sloth tribe discovered in South America, have been amply described in the works of Pander and d'Alton, Cuvier, Owen, and Lund, and the object of the present memoir is to give an account exclusively of the remains of the same family, which have been found in North America. The memoir was commenced six years ago, and during a portion of this time new discoveries afforded me an opportunity of giving a much more complete account of the osteology of the animals to which the memoir relates, than I could have anticipated.

Besides having had access to the cabinets of the Academy of Natural Sciences and American Philosophical Society of Philadelphia, of the New York Lyceum of Natural History, and of the National Institute in Washington, for the examination of remains of extinct sloths, I further had the opportunity of examining a large collection of specimens loaned to me by Dr. D. D. Owen, of New Harmony, Indiana, and others loaned by B. L. C. Wailes, Esq'r, of Jefferson, Mississippi, Prof. Jeffries Wyman, of Boston, Prof. J. D. Dana, of New Haven, and Prof. F. S. Holmes, of Charleston; to all of whom I offer my sincere thanks for the interest they have taken in the preparation of the work I now lay before them and the public.

A MEMOIR

ON THE

EXTINCT SLOTH TRIBE OF NORTH AMERICA.

MEGALONYX, Jefferson.

Megalonyx Jeffersonii, Harlan.

History.—The extinct genus of giant sloths, *Megalonyx*, was established by the enlightened and philosophic American President, Thomas Jefferson, in a communication read to the American Philosophical Society, March 10, 1797, entitled "A Memoir on the Discovery of certain Bones of a Quadruped of the Clawed Kind, in the Western Parts of Virginia."[1] The illustrious writer observes: "It is well known that the substratum of the country beyond the Blue Ridge is a limestone, abounding with large caverns, the earthy floors of which are highly impregnated with nitre. In digging the floor of one of these caves belonging to Frederic Cromer, in the county of Green Briar, the laborers at the depth of two or three feet, came to some bones, the size and form of which bespoke an animal unknown to them."

The bones which were preserved and obtained by Mr. Jefferson, consisted of a fragment of an os femoris, a radius, an ulna, three claws, and several other bones of one of the feet.

From the general resemblance of form of the claws to those of carnivora, Mr. Jefferson supposed the bones to have belonged to an animal of this character—a mistake of much less importance than many made by the best naturalists.

The specimens Mr. Jefferson subsequently presented to the cabinet of the American Philosophical Society, and they were then more particularly described in its Transactions, by Dr. Caspar Wistar.[2] The memoir of Dr. Wistar is accompanied by very good figures, of which one represents the restoration of the fore median digit, with its corresponding metacarpal bone.

From the form and arrangement of the bones of the feet, Dr. Wistar suspected the affinity of the *Megalonyx* to the recent sloths;[3] and Cuvier,[4] who afterwards described the same bones, from casts sent to him by Mr. Peale, of Philadelphia,

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[1] Trans. Amer. Phil. Soc., 1799; IV, 246.

[2] Ibid. VI, 526.

[3] Ibid. 530.

[4] Annales du Mus. V. 358; Ossem. fossiles, ed. 4, 1836, VIII, 304.

confirmed the opinion of Dr. Wistar, that they belonged to an animal of the sloth kind, in which determination he acknowledges the assistance of two additional specimens, said to have been obtained by M. de Beauvois, from the same cave in which were found those of Jefferson's collection. One of the new specimens, Cuvier observes, "qui est une dent etoit surtout important, parce qu'il achevoit de faire connoitre la nature de l'animal."

In relation to the locality from which the tooth just indicated was obtained, my friend, Major Le Conte, has informed me that it was not found in the same cave in which were discovered the specimens sent to Jefferson, but that M. de Beauvois obtained it from Mr. Clifford, who discovered it in White Cave, Tennessee.

Major Le Conte has further informed me that, at the time of the discovery of the bones of *Megalonyx* described by Mr. Jefferson, numerous others were found. These were carried away by different persons, and seem to have been all lost, except several phalanges sent to President Monroe, and which are now preserved in the museum of the Lyceum of Natural History, of New York.

Dr. Harlan[1] described some bones, which were found in Big-bone cave, Tennessee, and referred them to a distinct species of *Megalonyx* from that indicated by the specimens of Jefferson's collection, and gave to it the name of *M. laqueatus*, while the other he called *M. Jeffersonii.*

The specimens upon which the *M. laqueatus* was proposed, Dr. Harlan states, consisted "of two claws, one rib, and several remnants; os calcis, tibia, a portion of the femur; four dorsal and one lumbar vertebræ; a portion of a molar tooth, together with several epiphyses."[2] All these I have satisfactorily determined to belong to the *Megalonyx Jeffersonii*, as was previously suspected by Mr. William Cooper.[3]

Dr. Harlan subsequently described the fragment of a lower jaw, and a clavicle, which were likewise attributed to the *Megalonyx laqueatus*,[4] but the former specimen was determined by Prof. Owen, of London, to belong to a distinct genus, for which the name *Mylodon* had been previously proposed on some remains discovered in South America.[5]

Dr. Harlan further gave an account of an os ilium, from Big-bone cave, White County, Tennessee, which, like all the newly discovered specimens, was attributed to the *M. laqueatus*.[6]

Dr. Jeffries Wyman has described a tooth and the diaphysial portion of an ungual phalanx, from the vicinity of Memphis Tennessee,[7] which, as will be hereafter seen, are both attributable to the *Megalonyx Jeffersonii.*

Materials for Study.—The materials to which I have had access in entering upon the description of the *Megalonyx Jeffersonii* are as follows:—

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[1] Journ. Acad. Nat. Sci., VI, 269; Med. and Phys. Researches, 319.

[2] Ibid., 271; Med. and Phys. Researches, 321.

[3] An. Lyc. Nat. Hist., III, 166.

[4] Monthly Journ. of Geology, 74; Med. and Phys. Res., 334.

[5] Zool. of the Voyage of the Beagle, pt. 1, 63.

[6] Trans. Geol. Soc. of Penn., I, pt. 2, 347; Med. and Phys. Res., 336.

[7] Am. Journ. Sci. and Arts, 2d ser., X, 58.

1. The original specimens of Jefferson, which, together with a large collection of other organic remains, have been deposited by the American Philosophical Society in the cabinet of the Academy of Natural Sciences. These bones of the *Megalonyx Jeffersonii* consist of a radius and an ulna; the second, third, and fifth metacarpals; the second phalanx of the index finger, the first and last of the middle finger, the second and last of the annular finger, and the third of the thumb, all belonging to the left side. They are ochreous in color, unchanged in texture, compact, and heavy; and they have a polished surface. Several of the specimens, as is frequently the case in cave bones, present an appearance of having been gnawed by some rodent animal.

2. The specimens which formed the basis of Dr. Harlan's first memoir on the *Megalonyx laqueatus*.[1] They were presented to the Academy of Natural Sciences by Mr. J. P. Wetherill, and consist of bones of several individuals, as follows:—

a. A collection of bones of a young animal, nearly all of them having the epiphyses detached. They are the left scapula imperfect, the left os humeri without epiphyses, the right radius without its distal epiphysis, the proximal two-thirds of the right ulna, the right os calcis, the distal epiphysis of the right os femoris, the left tibia without its distal epiphysis, the distal epiphysis of the right tibia, one lumbar vertebra, four dorsal vertebræ with one exception without epiphyses, fragments of three right ribs, fragment of a left rib, and two ungual phalanges of the right hind foot. These were found in Big-bone cave, Tennessee. They are of a yellow color, comparatively light, unchanged in texture, and quite recent in appearance. Several of them are remarkable for retaining portions of articular cartilage, periosteum, and tendinous attachment; and one ungual phalanx has the nail preserved upon it almost entire. They also present the marks of having been gnawed by some small rodent. These specimens, Mr. Cooper very correctly supposed, belonged to the young animal of *Megalonyx Jeffersonii*.[2]

b. A rib of the left side, belonging to an adult animal; hard, compact, and unchanged in texture, and so resembling in appearance the specimens of Jefferson, that I am inclined to believe it belonged to the same skeleton. It was referred by Dr. Harlan to the same individual as the preceding bones, but being an adult specimen this is, of course, not possible. No specified locality is known for it; but, from the statements of Major Le Conte[3] and Mr. Cooper,[4] in relation to the discovery of the specimens described by Mr. Jefferson, that many others were found at the same time and carried off; this rib may be one of the lost bones.

c. A left os humeri of an adult animal from Big-bone lick, Kentucky. The specimen is dark brown in color, hard, compact, and heavy, and is unchanged, except in being infiltrated with oxide of iron.

3. An ungual phalanx of the right median forefinger, being one of the three bones referred to as having been sent to President Monroe. It, together with a fragment of the lower jaw of *Mylodon Harlani*, have been kindly loaned to me by the Lyceum of Natural History of New York, through one of its most active mem-

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[1] Journ. Acad. Nat. Sci., VI, pt. 1, 269.
[2] An. Lyc. Nat. Hist., III, 167.
[3] See ante.
[4] An. Lyc. Nat. Hist., III, 167.

bers, Mr. George N. Lawrence. The phalanx has exactly the same appearance and texture as the specimens of Jefferson, and as observed by Mr. Cooper, probably belonged to the same individual skeleton.

4. The tooth, and portion of claw described by Dr. Wyman, from the neighborhood of Memphis, Tennessee. These have been received through the kind attention of my friend, Mr. J. D. Dana, and are loaned from the cabinet of Prof. B. Silliman, Jr. The tooth is a first superior molar, is of large size, and is dull ferruginous in color. The portion of a claw is the ungual process of the median digit of a young animal, having the epiphysis detached and lost. It is of a dirty yellowish-white color, and is unchanged in its original texture.

5. A number of bones of an adult skeleton, which were discovered by Dr. M. W. Dickeson, in the vicinity of Natchez, Mississippi, associated with remains of the *Mylodon*, *Mastodon*, *Equus americanus*, *Bootherium*, *Cervus*, *Ursus*, *Tapirus*, etc. They were obtained, according to Dr. Dickeson, from a stratum of tenacious blue clay, which underlies the drift east of Natchez.[1]

The specimens, which are now preserved in the museum of the Academy of Natural Sciences, are compact, firm, and heavy, and are of a deep brown color, from the infiltration of oxide of iron.[2] They consist of a skull nearly entire, containing on one side the anterior three molars, and on the other the posterior four; the metacarpal bone and phalanges of an index finger; the first and ungual phalanges of a median finger; four carpal bones; portions of both scapulæ; a clavicle; a fragment of the sacrum; small fragments of both innominata; several fragments of ribs; and a hyoid bone.

6. A first superior molar tooth, and the fragment of a rib, and of an ungual phalanx, discovered by Dr. Dickeson, near Natchez, Mississippi, but not with the preceding. The three specimens are white, chalk-like, and friable, and apparently belonged to the same individual.

7. A first superior molar of the right side; a fourth upper molar; all the phalanges of the annular, median, and index fingers, and the auricular and annular metacarpals of the left side; and a right os femoris. These apparently belonged to four distinct individuals; and they were discovered in Adams County, Mississippi, and were kindly loaned to me by Col. B. L. C. Wailes, of the latter State. Most of the specimens are in an admirable state of preservation.

8. A supposed third superior molar tooth from Tuscumbia County, Alabama, loaned by my friend Prof. Jeffries Wyman.

9. A first and a third superior molar, from one individual, and a second superior molar, from a second individual, from Natchez Bluffs, Mississippi, loaned to me by Prof. Wyman.

10. A number of bones derived from a single skeleton, as follows: A nearly entire skull and lower jaw; the atlas, axis, and three other cervical vertebræ; one dorsal, one sacral, and one caudal vertebra, and small fragments of several others;

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[1] Proc. Ac. Nat. Sci., III, 106.

[2] With these specimens, and presenting the same general appearance of color, compactness, &c., was discovered the so-called fossil human innominate bone.—Ibid. 107.

both clavicles; the glenoid articulation of the right scapula; the left humerus: the articular extremities of the right ulna, and those of both radii; five carpal bones; four metacarpals; eleven phalanges of the fore feet; fragments of several ribs; one sternal bone; both thigh bones broken; both patellæ; both tibiæ; seven tarsal bones; five metatarsals; and five phalanges of the hind feet.

The bones are ochreous yellow in color, brittle, and fissured, but otherwise well-preserved. In relation to the locality from which they were obtained, I insert the following letter received from my friend Dr. D. D. Owen, with the date:—

NEW HARMONY, INDIANA, *September*, 18, 1854.

DEAR SIR: During my geological survey made this summer in Kentucky, I visited and examined the locality of the matrix of the bones of the *Megalonyx*, which form the collection I forwarded to you for description in the memoir you are engaged in preparing for publication, on the Fossil Edentata of the United States.

As my geological report on that part of Kentucky will not appear before the issue of your work, I proceed to furnish you with a short description of the geological position and locality of these interesting organic relics.

Travellers on the Ohio river will, doubtless, have noticed a remarkable rising ground, from five to six miles below Henderson, on the Kentucky shore, elevated considerably above the adjacent bottom land; and forming the site of a beautiful country residence, belonging to Mr. Walter Alves. It is to that gentleman I am indebted for the above valuable collection of bones sent to me in the summer of 1850.

To the east, above Mr. Alves's house, Canoe creek empties into the Ohio. Below the eminence on which the house stands, there is evidence of an ancient channel of a stream, probably that of the former extension of Canoe creek, which then swept round in a bend to the southwest, discharging its waters into Pond creek. The Ohio river gradually scooping away the Kentucky shore, encroached on the narrow neck of land intervening, and finally uniting, caused Canoe creek, as at present, to empty independently into the Ohio river.

In the bank of the Ohio river, a few paces below the above-mentioned mound-like elevation, the bones in question were found, seventy feet below the ancient channel of Canoe creek, and eighty-five feet below the site of Mr. Alves's house on the above elevated point of land around which Canoe creek meandered. The bone-bed is only some five or six feet above the ordinary low stage of water, lying intermixed and partially imbedded in a ferruginous sand charged with *Paludina ponderosa*, Say, *Melania canaliculata*, *Cyclas rivularis*, *Cyclostoma*, *Physa*, *Lymnea*, *Planorbis tricarinata*, Say, *P. lens*, and fragments of unios, with stems and limbs of trees.

Just beneath this ferruginous sand and shell bed, is a blue or rather a dark ash-colored clay. This clay has been most remarkably hollowed out into large cavities ("pot holes"). Into these cavities the ferruginous sand has been swept apparently by eddying currents of the Ohio river.

This ferruginous sand is very irregular as to thickness, forming rather isolated deposits than one connected, continuous bed. At a higher level (forty to fifty feet above the ordinary low water), the fine siliceous earths and marls are found, which are so universally distributed over the lower grounds in the vicinity of the Ohio, Mississippi, and Wabash rivers, even up to the height of one hundred feet and more, and which are locally characterized by several species of *Helix*, *Pupa armigera*, *Succinea*, *Cyclostoma*, &c.

Near the junction of the ferruginous sand and "blue" clay, many trunks of oak and other trees are seen projecting; often converted into a blackish-brown impressible charcoal or brown coal.

We were not able to discover an instance where the bones were fairly imbedded in the "blue" clay. They appear to originate in the ferruginous sand, and to be incrusted with the same material.

Though the ferruginous sand and "blue" clay lie at a lower level than the fine siliceous marly earths, I am not quite certain whether the former may not have been deposited subsequently, unconformably on the slope of the latter. If not unconformable, then the bone bed is older than the siliceous marly earths. This I hope to be able to determine this fall.

One thing, however, is very certain, both from the position of these bones and those found, under

analogous circumstances, in the banks of the Ohio, below Evansville, Vanderburg County, Indiana, that they are, comparatively speaking, of a *very recent date*, at least as recent as the origin of most of the existing species of univalve shells now inhabiting the Ohio river and its tributaries.

The bones of the *Megalonyx* sent to you for description were not found altogether, or at one time; but were picked up from time to time, and from year to year, as they happened to be washed out from their matrix, particularly after recent freshets.

I did not discover any further remains of edentata when I visited the locality last June, but obtained many horns and bones of deer, and probably of other ruminating animals; but, unfortunately, my collection made at that time has all been lost in the wreck of the Cape May, sunk this summer in the Ohio river, near Mount Vernon.

Description of the Skull.—The skull of the *Megalonyx Jeffersonii* in the collection of Dr. Owen has lost its malar bones and pterygoid processes, but otherwise, excepting a number of fractures and the loss of a few superficial fragments, is in a comparatively good state of preservation. (Plates I, II, III, VI, Figs. 2, 3.) It is accompanied by the lower jaw, broken in three pieces. (Pls. I, V.) The upper jaw contains all the teeth excepting the second of the left side and the last of the right side; but the lower jaw has lost all excepting the second and last of the right side.

In *Megalonyx Jeffersonii*, as in the Unau, the first tooth of the series, on each side in both jaws occupies a corresponding position, and in comparison with the other teeth gives the idea of its being a true canine.

Lateral View of the Skull.—(Pl. I.) In *Mylodon robustus* and in the Ai and Unau the upper outline of the skull is convex, but in *Megalonyx* it is nearly horizontal; departing from this course at the forehead where it is depressed, and upon the nose, where it is convex, though comparatively much less than in the Ai. The inion does not slope so much as in the latter and the *Mylodon*, and the anterior extremity of the face presents a vertically sigmoid outline.

The temporal fossa ascends to the median line of the cranium, and there terminates upon a prominent, rugged, sagittal crest; and inferiorly it is bounded by a rugged border, which separates it from the surface of origin of the external pterygoid muscle. Posteriorly it rests upon the strong root of the zygomatic process and the pyramidal border of the inion; and anteriorly its limits are defined by a semi-elliptical ridge, the free extremity of which forms an obtuse post-orbitar process, as in the Ai, and which in the *Mylodon* and Unau is developed into an angular apophysis. Viewed from its elevated margins, the temporal fossa is concave, but independent of these the surface is convex, and it is everywhere roughened by superficial decussating ridges, provided for the firm attachment of the fibres of the temporal muscle.

The zygomatic process projects outward and forward at an angle of about 45°; and it is also directed downward, and terminates with an obliquely truncated and roughened extremity. Its temporal surface forms a concave slope four and a half inches in length from the boundary of the inion. Its outer surface antero-posteriorly and vertically is concave, and in the latter direction has a greater diameter than in *Mylodon;* measuring just in advance of the middle two inches.

The mastoid process is a conspicuous object in the side view of the head. It forms the postero-inferior angle of the cranium, and is a strong, vertical, conoidal tuberosity. It is vertically excavated posteriorly, and curved slightly anteriorly.

Between the two processes just described a wide and deep arch is formed, within which is visible the external auditory meatus. This has a vertically oval aperture bounded inferiorly by a rugged V-shaped auditory process.

The face is relatively much shorter in advance of the orbit than in *Mylodon*, the Ai, and the Unau. Over the position of the first molar tooth it presents a convexity curving in the course of the latter downward and forward; and above this for a short distance it forms a nearly vertical plane, but its upper part is convex. Over the position of the posterior four molar alveoli it is slightly convex, and from the obtrusion of the teeth appears undulant. Between the position of the first and third molar and the malar process of the superior maxillary bone, the face forms a deep concavity.

The orbital surface is a vertical, oblique, and very shallow concavity, sloping upon the malar process outward, downward, and backward. Posteriorly it is defined from the temporal fossa by a superficial ridge hardly elevated at the middle, proceeding from the post orbitar process to the outside of the optic foramen. Anteriorly it is bounded by a general prominence of the face forming a sort of superciliary arch, and by a stout ridge constituted by the lachrymal bone resting upon the commencement of the malar process. The orbital surface of the lachrymal bone, presents a small oval foramen, the entrance of the lachrymal canal, which is directed inward, backward, and upward.

The malar process is directed outward and downward, and the lower part of its root is a short distance above the alveolar margin of the third molar tooth.

As before stated, the malar bones are broken off and lost from the specimen. In advance of the lachrymal bone the face presents a deep groove, which expands downward and backward upon the malar process and the commencement of the malar bone. The upper extremity of this groove has a small foramen opening into it; and about its middle is the exit of the infra-orbital canal, a vertically oval foramen directed forward, and placed about fourteen lines above the alveolar margin. The canal itself is an inch and a half in length, and the entrance to it is situated just posterior to the malar process and an inch and a half above the penultimate molar tooth.

Superior View.—(Pl. II.) A striking difference in the upper aspect of the skull of *Megalonyx* from that of *Mylodon*, is the separation of the temporal fossæ by a prominent, pyramidal, sagittal crest instead of a wide intervening surface. The sagittal crest in the specimen under consideration, is cleft by a deep wide fissure with smooth sides, which appears to be the gaping suture of the parietal bones. The temporal sides of the crest are rugged; and it proceeds at right angles from the marginal ridge of the inion to the frontal bone, upon which it bifurcates into prominent rugged ridges curving forward and outward to the post-orbital protuberances.

The temporal surfaces are convex and are most rough at their anterior half. Posteriorly, in the vicinity of the temporo-parietal suture and piercing the parietal and temporal bones, there are three venous foramina.

The face above is smooth and convex, and it does not expand forward as in

Mylodon, but, on the contrary, becomes narrower as in the Ai, though comparatively to a much less extent.

Inferior View.—(Pl. III.) The base of the skull of *Megalonyx* appears relatively narrower in comparison with its length than in *Mylodon.*

The occipital condyles are less sessile than those in the latter genus, and they also project more downward and backward. Their articular surface is bent about the middle, one-half being directed upward, backward, and outward, and the other half downward, forward, and outward.

The basilar process is relatively narrower and more uneven than in *Mylodon* or the Ai. Between the condyles it presents a concave border, in the median line it is convex, and on each side it slopes into a deep concave fossa, which is bounded anteriorly by a prominent rough protuberance, and extends postero-externally to the border of the inion between the condyle and para-mastoid process. About the middle of the fossa just indicated, there exists a deep oval pit or short canal formed by the conjunction of two anterior condyloid foramina. Between the rough protuberances mentioned, the basilar surface is concave; and anteriorly it is defined from the sphenoidal body by a serrated suture, which is convex forward.

The surface of the sphenoidal body is plane, and converges anteriorly between the roots of the pterygoid processes to an angular depression, terminating in a foramen or fissure passing above the base of the vomerine articulation.

The auditory process in the present view of the skull appears as a rugged V-shaped portion of bone, with a tuberous apex.

Wedged between the auditory process and a short inconspicuous para-mastoid process, there exists a robust, cylindroid tuberosity terminated by a concave discoidal surface for articulation with the stylo-hyal bone.

Internal to the process just described, is the jugular foramen, which is large and oval. Separated from the jugular foramen by a rough ridge, the carotid foramen is situated; and in advance of this, also separated by a rough ridge, which is an offset from the auditory process, there is a deep infundibular pit constituting the osseous continuation of the tympanic tube.

Piercing the base of the stylo-hyal process, between it and the mastoid process, there are two stylo-mastoid foramina.

Looking directly at the base of the skull, the foramina ovale and rotundum are nearly concealed from view by the roots of the pterygoid processes bending outwardly. Both are large and are directed forward. The former is situated between the posterior part of the root of the pterygoid process and the inner end of the glenoid articulation; the latter is placed about the third of an inch in advance of the other.

The glenoid articulation is elliptical in outline, and its long diameter is directed outward and forward. Antero-posteriorly it is nearly a plane, and measures about fourteen lines; and transversely it is concave, and measures two and a half inches.

The hard palate is relatively narrower than that of *Mylodon.* Between the posterior three molars it is only fourteen lines wide; and it forms a median convexity nearly as prominent as the protruding portion of these teeth. In advance of the third molars it gradually loses its convex character and expands into a nearly plane

surface, four inches in width at the posterior margins of the first molars, and two inches and a third at its anterior border. It is everywhere perforated by large vasculo-neural foramina, which communicate with a palatine canal piercing the hard palate on each side antero-posteriorly. The anterior extremity of the hard palate, between the position of the first molars, presents a large, oval, incisive foramen, which measures one inch and a half in the median line, and fourteen lines transversely. In front the incisive foramen is closed by the intermaxillary bones, which, in the present specimen, are separated by a narrow fissure, but are co-ossified with the maxillary bones.

The alveoli for the posterior four molars extend to more than half the depth of the face, and are nearly vertical in their direction except the last one, which curves backward and downward. The outer margin of their orifices is half an inch above the median convexity of the hard palate; and between this convexity and the exserted portion of the contiguous teeth, a deep gutter exists. The extent of the tract occupied by the posterior four molar alveoli is a little over three inches antero-posteriorly, and fourteen lines transversely.

From the first molars the others are separated by a hiatus, which presents a concave border outwardly, and in a straight line measures two inches.

Corresponding with an unusual degree of development of the first molar, its alveolus is large and deep; and it commences within the position of the upper part of the anterior orbital margin. In its course to the antero-inferior angle of the face it curves forward, downward, and very slightly outward. The long diameter of its orifice is directed forward and inward, and measures twenty lines.

Posterior View.—(Pl. VI, Fig. 3.) The occipital surface in outline has the same form as in *Mylodon*, but is relatively deeper in comparison with its breadth. The upper and lateral margins of the inion form a semicircle, and are roughened for muscular attachment.

The occipital condyles are nearer together, and are separated above by a deeper notch than in *Mylodon*. Their greatest distance from each other at the middle, is about two inches.

The occipital foramen is circular and is sixteen lines in diameter.

The median portion of the occiput is elevated into a narrow vertical crest which ceases near the occipital foramen. Upon each side the surface is rugged; and it presents about an inch below the summit of the inion a transverse crest, which at its outer part forms an irregular tuberosity.

Anterior View.—(Pl. VI, Fig. 2.) The end of the face is relatively narrower and higher than in *Mylodon;* and in outline is more vertically oblong quadrilateral, with the upper margin convex and the sides nearly vertical.

The orifice of the nose is irregularly circular, and is a little more than three inches in diameter. Inferiorly it is bounded by a broad sloping surface, formed by the antero-inferior portions of the alveoli for the first molars and the intervening intermaxillary bones.

The latter are simple, oblong, quadrilateral plates, a little more than two inches in depth, and three quarters of an inch in breadth.

The parts within the interior of the nose are too much broken to obtain any very definite idea of their form. The specimen is also broken in the guttural region so as to expose the capacious sinuses existing between the tables of the cranial bones.

Sutural Connections of the Bones of the Skull.—As previously stated, in the specimen under examination the sagittal suture remains open in the form of a deep cleft separating the two sides of the corresponding crest.

The fronto-parietal suture is completely obliterated, but its position is still traceable, commencing at the anterior extremity of the sagittal crest, and curving backward and downward about the middle of the temporal surface.

The temporo-parietal suture is serrated, and pursues a nearly straight course from the postero-superior extremity of the root of the zygomatic process downward and forward to the sphenoid bone.

The occipito-parietal suture remains open in the specimen, and courses along the semicircular margin of the inion until it reaches the temporal bone, when it abruptly turns posteriorly and descends in a line, which is convex inward to the point of separation of the paramastoid and stylo-hyal processes.

The sutures of the lachrymal and nasal bones are obliterated in the specimen.

Comparison of the Megalonyx Skull of Dr. Dickeson's Collection, with that of Dr. Owen's Collection.—The skull in the collection of Dr. Dickeson, though less complete than that first described, is, nevertheless, also in a comparatively good state of preservation; and as indicated by the more perfect obliteration of its sutural connections, it belonged to an older individual. (Pls. IV, VI, Fig. 1.) It has lost a portion of the face, the intermaxillaries, the malar bones, and the zygomatic and pterygoid processes, and it is unaccompanied by the lower jaw. The upper jaw on the right side has lost the first molar, and on the left side the last two molars.

This specimen presents a number of differences from that of Dr. Owen's collection, but none of them, I think, are of sufficient importance to characterize a distinct species.

The skull is shorter than Dr. Owen's specimen, but in a corresponding degree is both deeper and broader.

In the lateral view (Pl. IV), the upper outline is not so nearly horizontal, but above the temporal region is strongly convex, at the forehead is much more depressed, and at the face is less convex.

The inion is more vertical; and the temporal fossæ possess a greater vertical diameter, though their length is no less.

The squamous portion of the temporal bone is larger, is more elevated above the general level of the temporal surface, and also is rather more roughened by reticular ridges. The venous foramina in the vicinity of the temporo-parietal suture are larger.

In the upper view of the skull the anterior portion of the temporal region appears much more prominently convex than in Dr. Owen's specimen. The sagittal crest also is more elevated, and in this instance is not cleft. The ridges diverging from the latter anteriorly, are less prominent, but the post-orbital protuberances are a little more so.

The upper part of the face is shorter, and broader, and anteriorly is less sloping. In the present specimen the palatine canals become exposed and form a deep, concave, trilateral fossa situated just in advance of the middle of the position of the hiatus separating the first from the back molars. (Pl. VI, Fig. 1.) The antero-internal angle of the fossa is continuous with a shallow groove passing to the incisive foramen; and the antero-external angle communicates with a large canal ascending at the postero-internal side of the alveolus for the first molar. In Dr. Owen's specimen the shallow groove proceeding to the incisive foramen, is derived from a foramen communicating with the palatine canal.

The alveolus for the first molar is not so deep as in Dr. Owen's specimen; and its bottom does not reach within half an inch of the position of the anterior orbital margin, but this difference is probably dependent upon age merely.

Comparative Measurements of the Skulls of MEGALONYX JEFFERSONII *in the Collections of Drs. Owen and Dickeson.*

	Dr. Owen's specimen.		Dr. Dickeson's specimen.		
	Inches.	Lines.	Inches.	Lines.	
Length of the skull from the occipital condyles to the anterior margin of the first molar alveoli	14		13	3	
Length of temporal fossa to post-orbital protuberance	7	9	7	9	
Depth of temporal fossa in a straight line	4		4	6	
Length of face from post-orbital protuberance	4	8	4	5	
Height of face from most prominent part to middle of hard palate	6		5	9	
Breadth of face at post-orbital protuberances	4	11	5	5	
Breadth of face at anterior extremity	3	9	3	9	
Breadth of face at sides of first molar alveoli	4	6	4	6	estimated.
Height of face at anterior extremity	5		5		
Diameter of orifice of the nose	3	6	3	6	
Length of face from the first to the last molar alveolus	7		6	9	estimated.
Breadth of cranium at narrowest part of the temporal region	3	6	4		
Length of sagittal crest	5		5		
Height of inion from inferior margin of occipital foramen	4	4	4	4	
Breadth of inion at mastoid processes	6	3	6	6	

Inferior Maxilla.—(Pl. I, V.) The illustrious comparative anatomist of England, Professor Owen, has described, in the voyage of the Beagle (Mammalia, Pt. I, p. 99; Pl. xxix), a lower jaw which he attributes to the *Megalonyx Jeffersonii.* The specimen was discovered in South America, and Professor Owen remarks: "It is the only fossil brought home by Mr. Darwin, that could be confidently referred to the genus *Megalonyx;* but the form of the jaw fully justifies this determination."

The author further observes: "The forms of the alveoli are best preserved in the right ramus; the first is the smallest, and seems to have contained a tooth of which the transverse section must have been simply elliptical; the second tooth is likewise laterally compressed, but the transverse section is ovate, the great end being turned forwards; the third socket presents a corresponding form, but a larger

size; the fourth socket is too much mutilated to allow of a correct opinion being formed as to the shape of the tooth which it contained."

When the skull of the *Megalonyx Jeffersonii* in the collection of Dr. Dickeson, was first submitted to my inspection, from the large size of the first molar tooth, and its unusually advanced position from the other molars, I inferred the lower jaw above indicated could not belong to the genus *Megalonyx.* Further, the recedence posteriorly of the two sides of the lower jaw is much greater than it possibly could be in *Megalonyx Jeffersonii,* for according to Professor Owen's figure (Pl. xxix), representing the specimen reduced to two-thirds the size of nature, the distance between the alveoli of the two sides at any position is over four inches, whereas in the upper jaw of the skull of Dr. Dickeson's collection, the corresponding interval does not measure more than an inch and three-quarters.

Under these circumstances, as the lower jaw also differs in well-marked characters from that of *Mylodon, Scelidotherium,* &c., at an early period in preparing this memoir, I proposed for the new genus indicated by the specimen, the name *Gnathopsis,* and dedicated the species to Professor Owen under the name of *G. Oweni.*[1]

These views are entirely confirmed by the specimen of a lower jaw accompanying the *Megalonyx* skull in the collection of Dr. Owen.

In its general form the inferior maxilla of *Megalonyx* is like that of *Mylodon* and the recent sloths.

The outer side of the body of the jaw (Pl. I), is vertically and antero-posteriorly convex. Its front is relatively narrow compared with that of *Mylodon* and the Ai, and at the lower part is convex; but above it forms a prominent, pyramidal, keel-like ridge to the symphysis.

Over the position externally of the first alveolus the surface is uniformly convex, but at its upper part appears more so from the existence of a deep concavity between the first and second alveolus, and the presence of the anterior symphysial ridge.

The inner surface of the body of the jaw (Pl. V, Fig. 2), is a vertical plane; and the base is thick and convex.

The alveolus for the first molar is three and a half inches in depth, and is directed upward, forward, and outward; and its orifice presents a corresponding obliquity to that above.

The alveoli for the posterior three molars occupy a tract about three inches in length, by fourteen lines in width, and they descend to the base of the jaw. (Pl. V, Fig. 1). The hiatus separating them from the first molar is twenty lines long, and is constituted by a thick perforated border curving a little outward in its course forward.

The ramus is a broad, thin plate, which appears as if it was inserted into the body of the jaw on a line with the third molar alveolus. Its outer face is a vertical plane, and presents a well marked ridge for muscular attachment, sweeping from the anterior margin of the coronoid process in a semi-circle to the bottom of the angular process.

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[1] Proc. Acad. Nat. Sci., VI, 117.

The condyle is a convexity, two inches in transverse diameter, and about three-fourths of an inch in its antero-posterior diameter; and anteriorly it slopes to the bottom of the notch in advance.

The latter is much broader than in *Mylodon;* but the coronoid process is narrower, though relatively much broader and shorter than in the Ai.

The angular process also is relatively less broad than in *Mylodon*, and is shorter and deeper than in the Ai. It projects backward but not upward; externally it is convex and internally concave, and on both sides is strongly relieved by prominent ridges for muscular attachment.

The inferior dental canal commences at the base of the coronoid process, one inch and a half behind the last molar alveolus, and it presents one of its foramina of exit external to the position of the last molar just below the margin descending from the coronoid process, and the other at the side of the symphysial ridge immediately in advance of the first molar alveolus.

Measurements of the lower jaw.

	Inches.	Lines.
Length from angular process	12	6
Depth at condyle	4	3
Depth at coronoid process		6
Depth at third molar alveolus	3	7
Depth at hiatus separating the anterior two molars	4	

Dentition.—As in all the sloth tribe the teeth of *Megalonyx* are long, fangless columns, of uniform diameter in the adult condition; are deeply excavated from their bottom for the reception of a persistent dental pulp; and are arranged in the order of five molars upon each side in the upper jaw, and four molars upon each side in the lower jaw.

In *Megalonyx* as in the Unau, the anterior tooth of the series in both jaws is placed considerably in advance of the others, and in general form and position conveys the idea of its being a true canine tooth (Pls. I, III, IV, V, VI, Fig. 2).

As previously stated, the upper jaw of the skull in the collection of Dr. Owen contains all the teeth except the second on the left, and the last on the right side (Pl. III). The lower jaw accompanying the skull contains only the second and last of the right side (Pl. V).

Of the upper molars in the specimen just mentioned the first on both sides, when removed from its socket, is found to be perfect except in the loss of the thin edge of the pulp cavity. This tooth is strongly curved, being convex anteriorly and externally, and concave posteriorly and internally. Along the curve of the anterior border, it is five inches in length. In transverse section (Pls. III, XVI, Fig. 1), it is elliptical with an inner median bulge, which in a trifling degree extends more anteriorly. The triturating surface is worn concave in a sloping manner towards the edge posterior to the inner bulge of the tooth, and except in the latter position, is surrounded by an elevated border composed of the less worn, harder dentinal substance. At the anterior two-thirds of the outer margin of the triturating surface, the cementum is worn away for a short depth.

The pulp cavity extends in an infundibular form about two inches from its margin.

The antero-posterior diameter of this tooth is seventeen and a half lines; its greatest transverse diameter, nine lines.

The corresponding tooth preserved in the left side of the skull in Dr. Dickeson's collection, possesses the same form, but differs in being strongly impressed by three longitudinal lines upon its outer surface (Pls. IV, XVI, Fig. 2). Removed from its socket, this tooth is observed to have been in its perfect condition not more than two-thirds the length of those contained in the skull of Dr. Owen's collection, probably because it belonged to an old animal, and was worn away without an equal amount of reparation. This is rendered more likely from the fact that the pulp cavity reaches within a half an inch of the triturating surface of the tooth.

The antero-posterior diameter of the specimen is eighteen and a quarter lines; its greatest transverse diameter nine and three quarter lines.

The specimen of a first upper right molar tooth (Pl. VI, Figs. 4, 5; XVI, Fig. 4), from the neighborhood of Memphis, Tennessee, in the collection of Prof. Silliman, is more robust than those above described. Its outer side is also more plane and presents only the faintest indication of longitudinal depressed lines. Its antero-posterior diameter is nineteen lines; its greatest transverse diameter nine and a half lines.

The specimen of a first upper right molar tooth (Pl. XVI, Fig. 5), from Adams Co., Mississippi, in the collection of Prof. Wailes, is more convex on its outer side than in any of those previously mentioned, and it presents no trace of longitudinal impressed lines. Its antero-posterior diameter is eighteen and a half lines; its greatest transverse diameter nine and three-quarter lines.

The specimen of a first upper left molar tooth (Pl. XVI, Fig. 6), from Natchez Bluffs, Mississippi, in the collection of Prof. Wyman, is smaller than any of those described; but it has about the same form and proportions as that of Prof. Wailes' collection. Its antero-posterior diameter is sixteen lines; its greatest transverse diameter eight and three-quarter lines.

The isolated first molar (Pl. VI, Figs. 6, 7; XVI, Fig. 3), found in company with a fragment of a rib and an ungual phalanx, near Natchez, Mississippi, and now contained in Dr. Dickeson's collection, before having had the opportunity of inspecting any number of first molars of different individuals of *Megalonyx Jeffersonii*, I suspected from its differing so much from those examined, that it indicated a different species, for which I proposed the name of *Megalonyx potens*.[1] The tooth is relatively narrower in comparison with its antero-posterior diameter, than in any of those described, and its outer surface is more plane. The triturating surface is worn off obliquely and slopes postero-internally. The antero-posterior diameter of the specimen is twenty-one lines; its greatest transverse diameter nine and a half lines.

The first molar of the *Megalonyx*, described by Dr. Harlan, appears to be that of the upper left side.[2] Its form corresponds with those in the skull of Dr. Owen's

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[1] Proc. Acad. Nat. Sc., VI, 1852, 117. [2] See page 4.

collection. The measurements of a cast of this tooth are sixteen and a half lines in its antero-posterior diameter, and nine lines in its transverse diameter.

On commencing my investigations of *Megalonyx*, with only two specimens of first upper molar teeth before me, in addition to the one contained in the skull of Dr. Dickeson's collection, I found such differences of form as to lead me to the conclusion that they belonged to three distinct species, while a fourth was based upon the description of a tooth by Dr. Harlan.[1] Further discoveries have indicated a considerable extent of variation in the form of the same teeth in different individuals, so that I now feel convinced that at most there are not more than two[2] known species of North American *Megalonyx*, and perhaps only one.

As before stated, the first molar is lost from the lower jaw in Dr. Owen's collection; nor have I had an opportunity of inspecting a first lower molar tooth of the *Megalonyx*. A cast, which I made in clay of the first molar alveolus in the lower jaw above mentioned, presents a form like that of the corresponding teeth of the upper jaw, but it is a little more convex externally, and is of more uniform thickness, or its inner median bulge is less prominent, and anterior and posterior to this it is thicker. Its antero-posterior diameter is seventeen lines; its greatest transverse diameter is nine lines. (Pl. XVI, Fig. 7. *Section of the cast.*)

The tooth represented by Cuvier in figure 14 of the plate of the bones of *Megalonyx*, in the Ossemens Fossiles, judging from the view of the triturating surface, appears to me to be the first lower molar of the right side. In the corresponding upper molars, the triturating surface is nearly concealed when the teeth are viewed upon the inner side.

The posterior four molars (Pl. III), in the skull of Dr. Owen's collection, where nearest together are separated by an interval of several lines, which widens more or less towards the inner and outer sides of the teeth. The median pair are the largest and longest.

The second and third molars are nearly straight in their course, but incline very slightly outward; the fourth molar in addition, curves slightly backward; and the last of the series curves strongly backward in its course downward.

The second upper molar in section (Pl. XVI, Fig. 9, *d*), is quadrate with rounded angles. Its inner and posterior sides are the greater, and are nearly equal; and the remaining sides are also nearly equal, and are planes. The inner side is slightly convex, and the posterior side is nearly a plane and is directed obliquely outward.

The third and fourth molars are relatively much broader compared with their measurement antero-posteriorly, than in the second tooth of the series. In section (Pl. XVI, Fig. 9, *c*, *b*), they form an isosceles triangle with the base internal and

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[1] *Megalonyx Jeffersonii*, *M. laqueatus*, *M. potens*, and *M. dissimilis*. See Proc. Acad. Nat. Sci., VI, 1852, 117. The first upper molar in the skull of Dr. Dickeson's collection, I viewed as characteristic of *Megalonyx Jeffersonii;* that figured by Dr. Harlan (Journ. Acad. Nat. Sci., VI, Pl. XII, Figs. 7–9; Med. and Phys. Res., Pl. XII, Figs. 7–9), as characteristic of *M. laqueatus;* that represented in Pl. VI, Figs. 6, 7, and Pl. XVI, Fig. 3, of this memoir, as characteristic of *M. potens;* and that represented in Pl. XIV, Figs. 4, 5, 6; Pl. XVI, Figs. 8, 15, as characteristic of *M. dissimilis*.

[2] *Megalonyx Jeffersonii*, and *M. dissimilis*.

the angles strongly rounded. The anterior side is transverse and slightly convex, and the inner side is also convex. The posterior side is slightly concave and directed obliquely outward.

The last molar is a smaller tooth than the preceding pair, but has nearly the same form in a reversed position, the base of the triangular section (Pl. XVI, Fig. 9, *a*), being outward. Its posterior side is transverse and is slightly concave; and the anterior side is convex and directed obliquely inward.

The triturating surface of the last molar is broken off, but in the three preceding teeth it presents the form of a transverse concave valley sloping inwardly. Anteriorly and posteriorly the valley is bounded by an angular ridge formed from the harder dentinal layer of the teeth with the cementum worn from it in a bevelled manner. (Pl. III.)

The posterior four superior molars in the skull of Dr. Dickeson's collection, are very nearly like those just described. (Pl. VI, Fig. 1; XVI, Fig. 10, *d*, *c*, *b*, *a*.) The third molar is not as thick internally, and is a little thicker externally, so that the antero-posterior diameter is more uniform. The fourth molar is less broad and is more convex anteriorly; and the last of the series is a little broader, and in section is more elliptical. The triturating surface, which is preserved entire in the specimen of the latter tooth, presents a transverse valley like that of the teeth in advance.

Measurements of the Posterior four Superior Molars in the Skull of Dr. Owen's Collection.

	TRANSVERSE.	ANTERO-POSTERIOR.	
		INT.	EXT.
	Lines.	Lines.	Lines.
Diameter of second upper molar	9	8½	7
Diameter of third upper molar	12	9½	6
Diameter of fourth upper molar	12½	9	5
Diameter of fifth upper molar	10	3	6¾

Measurements of the corresponding Teeth in the Skull of Dr. Dickeson's Collection.

	TRANSVERSE.	ANTERO-POSTERIOR.	
		INT.	EXT.
	Lines.	Lines.	Lines.
Diameter of second upper molar	9½	8	7
Diameter of third upper molar	12½	8	6
Diameter of fourth upper molar	11½	8	6
Diameter of fifth upper molar	10½	4	6

The isolated superior back molar (Pl. XVI, Fig. 11), from Adams County, Mississippi, in the collection of Col. Wailes, approaches most in its form the fourth upper molar contained in the skulls above described. Its transverse diameter is eleven lines; and its antero-posterior diameter externally six lines, and internally seven and a quarter lines.

The supposed isolated superior third molar (Pl. VI, Figs. 8, 9; XVI, Fig. 13), from Tuscumbia County, Alabama, in the collection of Professor Wyman, is rela-

tively much less thick internally than those above described, and is also impressed with a longitudinal groove internally. Its triturating surface is worn into a transverse angular groove, the anterior and posterior margins of which are acute and have an oblique course reverse to each other. Probably this tooth may belong to a different animal from the *Megalonyx*. Its transverse diameter is twelve lines; and its antero-posterior diameter externally six lines, internally seven and a half lines.

The specimen of a small molar, accompanying the first superior molar and apparently belonging to the same individual, from Natchez Bluffs, Mississippi, in the collection of Dr. Wyman, appears to be a superior third molar; but its section (Pl. XVI, Fig. 12), approaches more the quadrate form than that of any of the corresponding teeth which have been described. Its triturating surface presents a deeper concavity than in any of the foregoing specimens of posterior superior molars. The transverse diameter of this tooth is eleven lines; its antero-posterior diameter externally six lines, internally seven and a half lines.

The isolated upper second molar (Pl. XVI, Fig. 14), from Natchez Bluffs, Mississippi, in the collection of Dr. Wyman, has nearly the form of the corresponding teeth in the skulls above described. It is broader transversely, and narrower antero-posteriorly, is less convex internally, and is impressed on its other three sides. Its transverse diameter is ten lines; its antero-posterior diameter externally six lines, internally seven and a half lines.

Of the two molars preserved in the lower jaw (Pl. V), of Dr. Owen's collection, the second of the series in transverse section (Pl. XVI, Fig. 16), is quadrate with rounded angles. The anterior and posterior sides are slightly convex, and the latter is the broadest. The lateral sides are smaller than the others, and are about equal, and they are slightly impressed at their middle. The triturating surface is concave, and bounded by an acute edge, which is most prominent antero-internally and at the postero-external angle.

A section of the socket for the third inferior molar is also quadrate, with rounded angles; and the anterior and posterior sides are broadest and about equal.

The fourth molar (Pl. VI, Figs. 10, 11; XVI, Fig. 17), like the preceding pair, is quadrate with convex sides; the outer one being oblique and slightly impressed. The triturating surface of this tooth (Pl. VI, Fig. 11), is worn into a transverse valley, whose boundaries are most prominent at the antero-internal and postero-external angles.

	Lines.
Transverse diameter of the second lower molar	11
Antero-posterior diameter of the second lower molar	$8\frac{1}{2}$
Transverse diameter of the fourth lower molar	$11\frac{1}{2}$
Antero-posterior diameter of the fourth lower molar	$8\frac{1}{2}$

Structure of the Teeth.—As previously stated, the teeth of *Megalonyx*, as in all sloth-like animals, consist of simple, long, fangless columns, deeply excavated from the bottom for the reception of a persistent dental pulp.

At the commencement of the pulp cavity the teeth form an exceedingly thin edge, and they very gradually increase in thickness to the apex of the cavity.

The extent of the pulp cavity appears to be subject to some variation, probably dependent upon the age of the animal. Thus, in the first superior molar contained in the skull of Dr. Owen's collection, the pulp cavity extends about half the length of the tooth, which measures nearly five inches; but in the corresponding tooth in the skull of Dr. Dickeson's collection, the pulp cavity reaches within three-fourths of an inch of the triturating surface. The latter specimen, however, in its perfect condition, has been at least an inch and a half shorter than the former, probably from its having belonged to an older animal in which the tooth, having further fulfilled its function, has been more worn away, for the alveolus is also more shallow than that in the skull of Dr. Owen's collection.

Characteristic of the family to which *Megalonyx* belongs, the teeth are entirely destitute of enamel, and in transverse section they exhibit a central disk of very porous dentine, surrounded by a much harder layer of the same substance, which is also inclosed by a thinner layer of cementum.

The harder dentinal layer is thickest where the teeth, in mastication, are most subjected to attrition. It appears less dense than the corresponding substance in the teeth of *Mylodon,* and the striæ and punctæ produced by the sides and extremities of its tubuli are much more distinctly visible to the naked eye. It has also a concentric disposition, as exhibited by a number of fine lines.

The cementum externally has a longitudinally striato-granulated appearance, and in section also presents a concentric arrangement.

In the first superior molars the harder dentinal layer is thickest externally and antero-internally, and is thinnest postero-internally. The cementum also holds the same relations of thickness in different positions. Upon the remaining molars the harder dentine and cementum are thickest anteriorly and posteriorly, and are very thin laterally.

Cervical Vertebræ.—Of the vertebræ of the neck, Dr. Owen's collection contains the atlas, axis, and three others, which appear to be the third, fifth, and seventh.

The atlas (Pl. VII, Figs. 1, 2) of *Megalonyx Jeffersonii* is about one-third less in size than that of *Mylodon robustus,* and possesses very nearly the same form.

The upper arch of the atlas is convex transversely, and measures twenty lines antero-posteriorly; and it is surmounted by a conoidal protuberance. The lower arch is nearly as convex as the former, but only measures an inch antero-posteriorly. The transverse processes are broad, are slightly convex above, and below present a deep concavity leading to the vertebral foramina.

The spinal canal is vertically oval and measures two and a half inches in its long diameter, and an inch and two thirds between the tubercles of attachment for the transverse ligament.

The articular facets for the occipital condyles are deeply concave and slope to the spinal canal. The posterior articular facets are oblique, ovoid, and slightly concave. The facet for articulation with the odontoid process of the axis is transversely elliptical, and measures an inch and a half in its long diameter.

The course of the vertebral artery is indicated by a tortuous passage, as follows: A deep channel commences above at the back margin of the transverse process,

passes on the outside of the contiguous articular process forward and inward, and then becomes continuous with a foramen, piercing the base of the transverse process downward and forward. The channel next continues a short distance on the under side of the transverse process, and then communicates with a second foramen piercing its base forward and upward. It now turns inward and forward from the latter foramen, and becomes continuous with a third foramen piercing the abutment of the upper arch of the bone above the position of the anterior articular process and turning inward and forward to the spinal canal.

	Inches.
Greatest transverse diameter of the atlas	$6\frac{3}{4}$
Length at the conjunction of the arches	$3\frac{1}{4}$

The body of the axis (Pl. VII, Fig. 3), with its process, is three and a half inches long; and posteriorly it presents a transversely elliptical surface, twenty-two lines wide and sixteen deep. The inferior surface possesses a prominent median ridge, upon each side of which it is concave. The odontoid process inferiorly supports an oblique, discoidal, articular facet for conjunction with the atlas; and superiorly presents a smaller facet for contact with the transverse ligament.

Viewed laterally, the spinous process presents a broad surface, terminated by an irregularly convex margin, at its widest part measuring three inches. Posteriorly the spinous process is excavated into a deep and wide vertical concavity, which expands below upon the roof of the spinal canal. The abutments of the spinous process or the sides of the spinal arch above the posterior articular facets, are nearly two inches wide, but between these facets and those anterior, they are only an inch wide.

The spinal canal is obcordiform, and anteriorly measures about twenty lines in its long diameter, but transcends this gradually by expansion posteriorly. The anterior articular facets are oval in outline and slightly convex. Those posterior are elliptical and transversely convex, and are directed downward. The transverse processes are elongated pyramidal, project outward and backward at an angle of about 45°, and posteriorly measure two inches and a quarter in length. The foramen for the vertebral bloodvessels pierces the base of the transverse process from behind outward and forward, and is visible laterally just behind the anterior articular process.

The remaining three cervical vertebræ, apparently the third, fifth, and seventh, have a demi-cylindroid body expanding posteriorly. (Pl. VII, Fig. 4.) The anterior surface of the body is transversely demi-oval and convex; and the posterior surface is oval and slightly concave.

The spinous process is long, tapering, and trilateral; and presents an acute margin anteriorly, and a thick, vertically grooved one posteriorly. In the seventh vertebra it is three inches in length, and has an irregular tuberous extremity. The spinal canal is trilateral, and has its vertical diameter the deeper in the third vertebra; but in the other two the transverse diameter is the greater. The articular processes form four projecting angles to the base of the spinal arch. Those anterior are most prominent, and present a concave facet directed upward and in-

ward, and bounded externally by a rounded protuberance. The posterior articular processes have convex facets directed downward and outward.

The transverse processes are supported by a pair of abutments, with the foramen for the vertebral artery intervening, of which one is derived from the side of the body, the other from the side of the spinal arch. At their outer part they are prolonged anteriorly and to a greater extent posteriorly; and they terminate in notched extremities.

The height of the fifth vertebra from the inferior margin of the body posteriorly to the end of the spinous process is five and a half inches, and the height of the seventh vertebra in the same position is seven inches.

Dorsal Vertebræ.—Of these there are two in the collection of Dr. Owen; one from the anterior portion of the series, the other from the posterior portion.

The specimen of an anterior dorsal vertebra has lost the posterior epiphysis of its body, and has its spinous process broken away. The body of this bone is transversely elliptical, and its anterior surface is a little over two inches in breadth and an inch and a half in depth.

The sides of the spinal arch are over two inches wide, and gradually spread from each other posteriorly. The anterior angles of their base curl upward into a process supporting the corresponding articular facet, which is concave and directed upward and inward. The posterior articular facets rest upon the under side of the posterior margin of the spinal arch. They are oval and slightly concave, and are directed downward and inward.

The spinal canal is trilateral and expands posteriorly. Its entrance anteriorly is a little wider than the body of the bone, but the vertical diameter is a little less. The spinous process, judging from its broken base, appears to have had the same form as in the posterior cervical vertebræ. The transverse processes extend nearly two and a half inches from the body, and at their extremity inferiorly present a deep concave facet for articulation with the tubercle of the rib. At the anterior part of the body on each side, a small articular facet exists for articulation with the head of the rib.

The breadth of this vertebra from the extremities of the transverse process is seven inches.

The posterior dorsal vertebra above indicated is in three fragments, and the body has lost its anterior epiphysis. The specimen is twice the bulk of that just described. The body of the bone is demi-cylindroidal and constricted between the epiphysial surfaces. The posterior epiphysis is three and a half inches broad and three inches deep.

The spinous process is five and a half inches in length from the margin anteriorly of the spinal canal, inclines backward, and terminates in a stout convex tuberosity. The spinal canal is nearly circular, and is about two inches and a half in diameter. The anterior and posterior articular processes are simple elliptical planes, resting upon the corresponding portions of the spinal arch; the former being directed upward and slightly outward and forward, the latter downward and slightly inward and backward.

The transverse processes are thick, curved tuberosities, projecting from the spinal

arch, on a line with the posterior articular processes. They present on their outer face a convex articular facet for junction with the tubercle of the rib; and at the side of the spinal arch, below the position of the anterior articular processes, a concave facet exists for junction with the head of the rib.

The height of the posterior dorsal vertebra just described, from the postero-inferior margin of its body to the extremity of the spinous process is nine inches; its breadth at the transverse processes is six and a half inches.

Sacrum.—The fragment of a sacrum in the collection of Dr. Dickeson consists of the upper part of the anterior three divisions of the bone; and it is eight and a half inches long. The spinal canal at the position of the first segment, is over three inches in breadth, and it appears to have retained this size as far back as the fragment extends. The spinous processes form a thick ridge, which is elevated about an inch and a half above the surface of the spinal canal. The anterior extremity of the fragment presents a broad process, formed by the conjunction of the first sacral spinous process with the contiguous articular processes, appearing to have served the purpose of a protection to the interval between the last lumbar vertebra and sacrum.

The last sacral vertebra (Pl. VII, Fig. 5), in the collection of Dr. Owen, resembles in its form the corresponding bone of *Mylodon* and the recent Ai. Its body is transversely elliptical; and at its anterior articular facet is slightly convex transversely, and at its posterior facet in the same direction is slightly concave. The breadth of the body anteriorly is three and a half inches, and its depth nearly two inches. Posteriorly it is three and a quarter inches broad, by two and a half deep.

The spinal canal is crescentic with rounded extremities; and it measures three inches in breadth by one and a quarter in depth. The spinous process is a short thick ridge elevated about an inch above the surface of the spinal canal. The anterior articular processes are prominent tuberosities projecting forward from the spinal arch and supporting a small concave facet upon their inner side. The posterior articular processes are slightly tuberous, and present their facet outward and downward. The transverse processes are thick and strong, and project outward and backward for four and a half inches from the body, and anteriorly they present a long, oblique, rough surface for conjunction with the ischium.

The height of the last sacral vertebra is four and a half inches; its breadth is ten and a half inches.

Coccyx.—Of the two coccygeal vertebræ in the collection of Dr. Owen, one belonged to the anterior part of the tail, the other to the posterior part.

The anterior vertebra (Pl. VII, Fig. 6), is broken into two. Its body is subcircular, and is bounded by pentahedral articular faces, which are slightly convex. The posterior face is continuous below with a pair of sloping facets for articulation with a chevron bone. The breadth of the anterior surface of the body is three inches, and its depth two and three-quarter inches. The spinal arch is broken away; but the canal between its abutments measures about an inch and a half in width. The posterior articular processes are also broken away. Those anterior project obliquely from the antero-superior angles of the body; and they form a stout tuberosity, supporting an ovoid articular facet upon their inner side. The transverse processes

project backward and outward from the side of the body for about two inches; and they are trilateral, and have a thick tuberous extremity.

The specimen of a posterior coccygeal vertebra has a transversely elliptical body with an anterior hexahedral and a posterior oval articular surface. Both of the latter are convex, or rather they are centrally very slightly depressed, and at the circumference are bevelled off. The anterior surface is two inches and a third in breadth, by one and three-quarters in depth, and that posterior is two inches in breadth, and one and a half in depth. The inferior surface of the body presents two pairs of short tuberosities for articulation with chevron bones. The spinal canal is open, and is bounded upon each side by a wing-like process, the rudiment of the articular processes. The transverse process is broad and thick, measures two inches in length, and projects outward and backward.

Hyoid Bone.—The hyoid bone (Pl. VII, Figs. 7, 8), of *Megalonyx*, in comparing it with the figures of this bone of the recent sloths in Blainville's Osteographie, is found to resemble most that of the Unau.

The specimen in the collection of Dr. Dickeson, is a V-shaped bone, with a pair of anterior tubercles separated by a deep notch, and supporting a circular, shallow concave, articular facet for the cerato-hyal element. The diverging arms of the bone from its anterior angle are about two inches eight lines in length; and they terminate in a circular convex facet.

Ribs.—The adult specimen of a rib described by Dr. Harlan,[1] consists of about two feet of the vertebral portion, and is peculiarly interesting from its presenting the indications of a fracture, which existed a foot and a half from the head of the bone, and had so well healed that no deformity exists except a convex thickening upon the inner side. This fact is additional evidence in support of the view ingeniously inferred by Professor Owen, that the giant sloths were very liable to accidents not unfrequently involving fracture of the bones, from the habit of uprooting trees, the boughs of which formed their food. The head of the bone presents a single convex articular facet, and the tubercle another, which is deeply concave.

Of the several small fragments of ribs in the collection of Dr. Owen, one of them at its broadest part measures two inches. Of the fragments of ribs in Dr. Dickeson's collection, one is a sternal extremity, and this presents the same form as the corresponding part in *Mylodon* and the Ai.

Scapula.—The fragment of a scapula in Dr. Owen's collection, preserves the glenoid articulation, which is ovoid, and is three and a quarter inches long by two and a half wide; is over an inch in depth from the level of its end margins, but is not more than the fourth of an inch in depth from the level of its side margins.

Of the portions of both scapulæ in the collection of Dr. Dickeson, one consists of the glenoid articulation and coraco-acromial arch of the left bone (Pl. VIII, Figs. 1, 2); the other of the base and posterior angle of the right one.

The form of the restored scapula of *Megalonyx* is very much like that of *Mylodon*.

The subscapular fossa presents a strongly folded appearance from the alternation of ridges and sloping surfaces. The ridges converge to the cervix, and the inter-

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[1] See *ante*, p. 5; Journ. Acad. Nat. Sci., VI, 271, 279, Pl. xiv, Fig. 16; Med. and Phys. Obs., 321, 326.

vening surfaces form trilateral concavities, roughened in many places with reticular risings, more especially near the base of the bone, for muscular attachment.

The dorsum (Pl. VIII, Fig. 1), as in *Mylodon*, is nearly equally divided by the spine into two deeply concave fossæ, which are roughened with reticular ridges.

The infra-spinatus fossa is strengthened below by a prominent ridge, commencing in a gradual manner at the base, about two inches from the posterior angle, and proceeding forward to form the anterior portion of the inferior costa of the scapula. At the cervix the fossa is impressed with a pair of broad, shallow, vascular channels, diverging into a number of branches at the root of the spine. In the course of two of the latter branches are large nutritious foramina.

The supra-spinatus fossa at its lower part is more capacious than the corresponding portion of the infra-spinatus fossa, and at the side of the root of the coracoid process it is pierced by a nearly circular coracoid foramen, a little over an inch in diameter. From the latter, two feebly marked vascular channels proceed to the root of the spine, at which position one of them is continuous with a large nutritious foramen.

The base of the scapula is antero-posteriorly convex, and forms a thickened boundary to that part of the bone.

The specimen of the posterior angle of the left scapula, in Dr. Dickeson's collection, presents an irregular cicatrix, in the course of which is a crooked foramen over an inch in length, indicating the former existence of a fracture of this portion of the bone during the life of the animal. This is another instance added to those previously given, proving the great liability of the giant sloths to accidents resulting in fracture of the bones.

The spine commences in a broad, trilateral, roughened surface at the base of the bone, and gradually rises until it arches over the outlet of the supra-spinatus fossa to become confluent with the coracoid process. Its root appears very thick from the fact that the dorsum of the bone is elevated in a pyramidal manner to support it.

The coraco-acromial arch (Pl. VIII, Fig. 2) is five inches long, and at its broadest part is about two inches wide; and it is elevated over two inches from the bottom of the supra-spinatus fossa.

The glenoid articulation (Fig. 2) is three and three-quarter inches long, and a little less than two and a half wide; and it presents the same form as that in Dr. Owen's specimen already described.

The estimated length of the scapula, from the summit of the coracoid process to the posterior angle, is one foot and a half.

The specimen of a young scapula, in the collection of the Academy of Natural Sciences, is interesting in relation to the mode of development of several of its parts. It is of the left side, and with the exception of the coraco-acromial arch, and superior margin, and a large hole through the infra-spinatus fossa, is nearly perfect. (Pl. VIII, Fig. 3, 4.) The coracoid process exists as a distinct bone, which is compressed cylindroid at its middle, and dilated towards the extremities. (Fig. 3, A.) The base of the coracoid bone is received into a deep angular notch (Fig. 3, A, B), between the coracoid foramen and an epiphysis (Fig. 3, C), which forms the anterior half of the glenoid articulation; and the other extremity presents a rough

pitted surface for junction with the acromion. The glenoid epiphysis (Fig. 3, c) just mentioned, is situated between the coracoid bone and the posterior portion of the glenoid articulation from which it is divided by a transverse tortuous fissure. The articular surface of the epiphysis is smooth, but that of the remainder of the glenoid cavity is pitted as if it had had a thin epiphysial plate attached.

Clavicle.—The clavicles (Pl. VIII, Fig. 5), preserved in the collection of Dr. Owen, are simple, much compressed, cylindroid bones, with a single curvature. They present two broad surfaces; one slightly convex in its length, the other slightly concave. Of the two margins one is longitudinally convex and subacute, the other concave and obtuse. The sternal extremity is the more expanded; and it presents a broad, subcircular, convex, articular head. The acromial end is flattened oval, and is rough. The length of the clavicle is eight and three-quarter inches, and its breadth two and a quarter inches.

The clavicle in Dr. Dickeson's collection is rather smaller than those just described; its length being half an inch less, and its breadth three-quarters of an inch less.

Humerus.—(Pl. IX, Figs. 1, 2.) The two specimens of the humerus preserved in the collection of Dr. Owen, are spade-shaped bones; and have a straight, cylindroid shaft with the distal extremity expanded into a broad trilateral plate. They are relatively much shorter than in the recent sloths, but are both absolutely and relatively longer than those of *Mylodon robustus,* and also are broader inferiorly.

The upper two-thirds anteriorly of the diaphysis are occupied by a superficial trilateral tract (Fig. 1), the base of which is formed by the outer tuberosity. This tract is slightly concave longitudinally and for the greater part of its length is convex transversely; and its apex or lower end is bounded by prominent lateral margins. It is neither so long, nor so conspicuous and rough as in *Mylodon.* Posteriorly the upper two-thirds of the shaft are cylindroid, and present several low longitudinal ridges for muscular attachment (Fig. 2).

The head of the bone (Figs. 2, 3) is demi-oval, with the long diameter directed antero-posteriorly, and measuring four inches, while the short diameter is three and a quarter inches.

The tuberosities (Figs. 2, 3) are broad, thick, and strong, are nearly equal in size, and are placed upon each side of the shaft anteriorly. Their bases are confluent in front, in which position they are separated by a shallow depression. The internal tuberosity is slightly smaller and lower than the other, but in a trifling degree projects more laterally. A shallow groove defines the tuberosities from the head of the bone, and in its course presents several large nutritious foramina.

The cubito-brachial articulation resembles in form one-half of an hour-glass (Figs. 1, 2, 4), or it consists of a pair of convex condyles conjoined by an intervening concave surface, which latter, together with the inner condyle, belong to the ulnar articulation; but the outer condyle is rather larger and more prominent than the former.

The internal condyloid process is very much more prominent than that of *Mylodon;* and it is in the form of a thick pyramidal plate, with a tuberous apex, which projects more than three inches beyond the line of the inner condyle. Its lower margin is oblique, and is over four inches in length, and at the apex of the

process it expands into a large and rugged subcircular surface for muscular attachment. Its base is pierced with a large but short oval canal, which commences at its upper margin posteriorly, and proceeds obliquely to its anterior surface, and there terminates in a deep concave fossa. This canal is a peculiarity in the anatomy of the *Megalonyx* among bradypoid animals, as it does not exist in the recent sloths, nor in *Mylodon*, nor *Megatherium*. It is about two inches wide by one in height, and is formed by a bridge of bone over an inch wide, which is extended from the shaft near the end of the deltoid tract to the apex of the contiguous condyloid process.

The outer condyloid process is a keel-like plate with a longitudinally convex margin, which is rough and becomes thickened inferiorly. Between this process and the boundary of the deltoid tract, the shaft of the bone presents a concave surface descending from its outer to its anterior side, constituting the musculo-spiral course, which does not appear so deep as in *Mylodon*, in consequence of the less degree of prominence of the deltoid tract.

The surface anteriorly of the humerus between the condyloid processes is transversely slightly convex; but at the base of the inner condyloid process it presents a deep concave fossa, previously mentioned; and just above the radial condyle it is slightly and irregularly depressed. The posterior surface, between the condyloid processes, forms an extensive trilateral plane with the middle part slightly depressed, but above the ulnar trochlea, it presents a shallow concavity to accommodate the olecranon process.

	Inches.
Length of humerus	20
Breadth at tuberosities	5¾
Breadth at middle of shaft	3¼
Breadth at condyloid processes	10½
Breadth of cubito-brachial articulation	5¼
Circumference of shaft at middle	9

The adult specimen of a humerus, in the collection presented by Mr. J. P. Wetherill to the Academy of Natural Sciences, and ascribed by Dr. Harlan to his *Megalonyx laqueatus*,[1] without doubt belongs to the same species as the preceding. It is rather smaller than those above described, and the anterior surface between the condyloid processes is more convex. In it also the concavity above the ulnar trochlea posteriorly is deeper, and that above the radial condyle anteriorly, is more distinct. Its length is eighteen and a half inches.

Bones of the Forearm.—(Pl. IX, Fig. 5; X, Fig. 1.) The bones of the forearm of *Megalonyx* in the collection of Jefferson are nearly perfect. They are a third longer than those of *Mylodon robustus*, but are narrower.

Radius.—(Pl. IX, Fig. 5; X, Fig. 1.) The radius is a long, clavate bone, slightly bent forward; and it is longitudinally convex upon its dorsal aspect and outer margin, and concave upon the opposed surface and ulnar margin. The distal three-fourths of the shaft are about three times as broad as thick; and the upper fourth

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[1] Journ. Ac. Nat. Sci., 1830, VI, 272, Pl. 13, Fig. 10; Med. and Phys. Res., 321.

appears as if its margins had been pressed towards each other anteriorly so as to form between them a concave gutter expanding below. The anterior surface of the bone generally is slightly concave transversely, and is a little roughened for muscular attachment. The posterior surface presents an oblique ridge extending along the middle half, from which it slopes on each side to its margins. The outer margin is obtuse, and in the specimen under examination presents the appearance of having been gnawed by some rodent animal. The inner margin is thin at the middle, but expands below into a broad, trilateral, rugged surface, for ligamentous conjunction with the ulna; and at the upper part it is directed forward to the bicipital tuberosity, which is convex and almost two inches long.

The head of the radius is oval; and it measures two inches and two-thirds antero-posteriorly, and two inches and a sixth transversely. Its brachial articular surface is a lenticular concavity with the border convex; and its ulnar facet is demi-circular in outline and transversely convex.

The carpal articulation (Pl. IX, Fig. 6) is a deep trilateral concavity which is open at the ulnar margin. It is three and a quarter inches broad, by two inches and a third internally. Its outer end is bounded by a strong styloid process; its anterior margin is acute; and posteriorly it is strengthened by means of a broad, convex, and rough tuberosity. Between the latter and a ridge existing upon the back of the styloid process there is a broad groove to accommodate the extensor tendons; and a second and deeper groove exists between the posterior part of the styloid process and an oblique ridge ascending from the outer margin of the bone.

	Inches.	Lines.
Length of radius to the end of the styloid process	17	9
Greatest breadth at the distal end	3	7
Breadth at the middle of the shaft	3	3

The articular extremities of both radii contained in Dr. Owen's collection, correspond pretty closely with the same parts of the specimen above described. The brachial articulation is rather more circular, and in a trifling degree deeper; and the ulnar articulation of the head is a little smaller. The bicipital tuberosity is stouter, but is directed less forward, so that the contiguous anterior surface of the bone appears less concave; inferiorly, however, the continuation of the same surface is more concave transversely.

The measurements of the fragments are as follows:—

	Inches.	Lines.
Antero-posterior diameter of the head	2	8
Transverse diameter of the head	2	2
Breadth of distal extremity	4	3
Breadth of carpal articulation	3	3
Greatest antero-posterior diameter of the carpal articulation	2	4

Ulna.—(Pl. IX, Fig. 5; X, Fig. 1.) The specimen of an ulna in the collection of Jefferson is a broad, compressed bone, which, like the radius, is slightly bent anteriorly. Its dorsal aspect and inner margin are longitudinally convex, while the palmar aspect and radial margin in the same direction are concave.

The dorsal and palmar surfaces of the shaft are slightly depressed, and are

roughened with reticular ridges for muscular attachment. The inner margin is thinner than the outer; and from its lower third it inclines backward, and along the upper part of its course is rough. The radial margin is obtuse, and at the middle it conjoins with a rough ridge ascending posteriorly from the distal end of the bone. Its lower extremity dilates into a demi-ovoid protuberance, which articulates with the radius.

The proximal extremity is not only the broader, but also the thicker part of the bone. Its anterior surface between the coronoid process and olecranon is deeply concave and roughened for muscular attachment. From the corresponding posterior surface there rises a pyramidal process, which supports a cordiform articular facet, about an inch in diameter, for the head of the radius.

The olecranon is broad and thick, is curved antero-superiorly, and ends in a tuberous apex. Its posterior side is convex and rugged, and at the inner margin of the bone presents a broad, ovoidal surface for the insertion of the extensor cubiti muscle. The coronoid process rises from the radial margin of the bone; and anteriorly it forms a prominent convex tuberosity. At its base postero-inferiorly is a superficial rough process for the tendinous attachment of the brachialis muscle.

The brachial articular surface (Pl. IX, Fig. 7) is two inches in width, and curves in a sigmoid manner from the summit of the coronoid process to the posterior side of the base of the olecranon. In the latter position it is transversely convex, but upon the coronoid process is slightly concave. Longitudinally, from its upper margin to the summit of the coronoid process, it is deeply concave. The radial articular surface is separated from it by a narrow irregular tract.

The distal extremity of the bone partakes in the general compression, but is thicker and narrower than the middle of the shaft. Its outer margin presents an ovoid tuberosity for articulating with the radius. The inner margin presents a long, trilateral, convex surface, roughened at its lower part for attachment of the internal lateral ligament of the wrist.

The carpal articular surface (Pl. IX, Fig. 6) rests upon a short cylindroid process which forms a protuberance anteriorly, corresponding to the technical styloid process. The articular surface inferiorly is an antero-posterior ellipsoidal concavity, prolonged nearly at a right angle upon the antero-internal side of the styloid process.

	Inches.
Length of ulna from olecranon to styloid process	20
Greatest breadth from the summit of the coronoid process	5
Greatest breadth of distal extremity	3
Breadth at middle of shaft	3

The fragments of the ulna in Dr. Owen's collection are rather larger than the corresponding portions of the bone above described. The brachial articulation is confluent with that for the radius, and the two posteriorly form a continuous acute border. Between the radial articular surface and the base of the coronoid process, the bone forms an irregular concave fossa, prolonged below to the radial margin. The corresponding position in the ulna of the Jefferson collection forms a plane above, and becomes convex in its descent.

The coronoid process is less thick and prominent anteriorly than in the specimen

just referred to, and the oblique margin of the olecranon above the brachial articulation is narrower. The distal end is narrower and thicker than in the specimen of the Jefferson collection, so that its styloid process appears less prominent anteriorly.

Measurements derived from the fragments of the ulna are as follows:—

	Inches.	Lines.
Greatest breadth of the ulna from the summit of the coronoid process	$5\frac{1}{2}$	
Greatest breadth of distal extremity	2	10
Breadth at middle of shaft	3	4

Carpus.—As in *Mylodon*, the carpus of *Megalonyx* is composed of seven bones placed in two rows, the odd bone, which is the homologue of the scaphoides and trapezium being common to both genera.

Of the seven bones, specimens of all are preserved in the collections of Drs. Owen and Dickeson except one: the trapezoides. Dr. Owen's collection contains the scapho-trapezium of both sides, a lunar, and a pisiform bone. Dr. Dickeson's collection contains a lunar, a cuneiform, and a pisiform bone, and an os magnum.

Os Scapho-trapezium.—(Pl. VIII, Figs. 6, 7, 8, *A*.) The scapho-trapezial bone is the largest of the carpus, and is irregularly pyramidal with the apex, formed by the trapezial portion, curved forward.

The proximal articulation (Figs. 6, 8, *A*) for the radius is one uniform convexity, with an irregularly crescentic outline, extending the whole breadth of the bone.

The distal surface (Fig. 7, *A*) is divided into three nearly equal portions; one on the outer side (*c*), an oblong convex articulation for the metacarpal of the thumb; another towards the dorsum (*d*), deeply concave, for junction with the trapezoides; and the third is an irregular surface for ligamentous attachment.

The ulnar side of the bone presents a reniform, articular surface, for the lunare, and below this a rough, interarticular surface continuous with a deep gutter passing to the distal side, and separating two articular facets for the magnum (Fig. 7, *e*, *f*); that anterior being circular, that posterior, quadrilateral.

The dorsal surface is inconspicuous, but the palmar surface (Fig. 6, *A*), is large and concave.

Os Lunare.—(Pl. VIII, Figs. 6, 7, 8, *B*; 9, 11, *A*.) The lunare is a wedge-shaped bone almost a third smaller than the scapho-trapezium. Its proximal and distal articular surfaces are separated by an irregular interarticular tract perforated by vascular canals.

The proximal articulation (Fig. 8, *B*; 11, *A*) is a broad, antero-posterior convexity for conjunction with the radius, and is continuous on its outer side, at an acute angle with a reniform articular surface corresponding to that of the scapho-trapezial bone.

Distally, the lunare presents a narrow antero-posterior concavity (Fig. 7, *B*, *g*), for junction with the magnum; and it is continuous on the ulnar side nearly at a right angle with a larger concave articular facet for the cuneiforme (*h*).

As in the preceding bone, the palmar (Fig. 6, *b*) is more extensive than the dorsal surface.

The specimen of a lunar bone in the Dickeson collection besides being smaller, is relatively narrower transversely, and its distal articulation forms a plane instead of being concave, and inclines towards the radial side, except at the forepart, where it is partially bent to the opposite side.

Os Cuneiforme.—(Pl. VIII, Figs. 9, 11, *B.*) The cuneiform bone is irregularly pyramidal, and second in size in the carpus.

The specimen is broken at its dorsal surface, but this appears to have been as extensive as the palmar surface, which is large, irregular, and perforated. (Fig. 9, *B.*)

The proximal surface of the bone exhibits a broad transverse convexity (Fig. 9, *B*, *e*; Fig. 11, *B*, *c*), for articulation with the ulna, narrowing antero-posteriorly towards the inner extremity, which is bent forward to articulate with the pisiforme. (Fig. 9, *f*; 11, *d.*)

The distal surface presents a broad, transverse, sigmoid concavity for conjunction with the unciforme, and at its inner extremity is bent backwards to join the metacarpal of the little finger.

Os Pisiforme.—(Pl. VIII, Fig. 14.) The pisiforme is an irregular, oblong, lenticular bone, with an obtuse margin. Its dorsal surface is a little convex and rough for tendinous attachment. The palmar surface is concave superiorly; and forms a prominent ovoidal tuberosity below. The antero-external margin presents a single, elliptical, articular surface (Fig. 14, *a*), bent near its middle; the lower portion being intended to join the cuneiforme, the other portion to join the ulna. The specimen in the collection of Dr. Dickeson, is a fifth smaller than that described, and it has its articular surface more bent at the middle.

Os Magnum.—(Pl. VIII, Figs. 10, 12, 13, *A.*) The os magnum, in this instance indicating the impropriety of many names in anatomy, is the smallest bone of the carpus. It is irregularly wedge-shaped, and is situated between the scapho-trapezial, lunar, trapezoid, unciform, and median metacarpal bones, with all of which it articulates. Proximally it presents an oblique plane (Figs. 10, 12, *d*), for articulation with the lunar bone; and continuous with this facet on the inner side is one for the unciform bone.

On the outer side it presents at the dorsal border a tripartite articular facet, separated by a deep interarticular groove from an oval facet at the palmar border. The tripartite facet articulates with the scapho-trapezial, the trapezoid, and median metacarpal bones; and the oval facet (Figs. 10, 12, *c*) articulates with the trapezial portion of the scapho-trapezium.

The distal surface presents two articular facets; an inner one (Fig. 13, *d*), extending from the dorsal to the palmar borders, and an outer one (Fig. 13, *c*), constituting a portion of the tripartite facet above mentioned, and separated from the other by an interarticular tract. The two distal articular facets join the median metacarpal bone, but the corresponding surface on a specimen of the latter (Pl. X, Fig. 13), belonging to a different skeleton, is undivided, that is to say, there is no interarticular tract separating the smaller from the larger articular facet.

The dorsal and palmar surfaces, of which the latter (Pl. VIII, Fig. 10) is the larger, are irregular and perforated for ligamentous attachment.

Os Unciforme.—(Pl. VIII, Figs. 10, 12, 13, *B.*) The unciform bone is irregularly pentahedral, and is the third in size of the carpus.

Proximally it presents a large, transverse, oblong square, sigmoid facet (Figs. 10, 12, *e*), for articulation with the cuneiform bone, and this is continuous on the outer side with another and smaller facet for the os magnum. The distal articular surface (Fig. 13, *B*) is tripartite, and irregularly trapezoidal in outline, and it joins the median metacarpal (*e*), the annular metacarpal (*f*), and the auricular metacarpal (*g*) bones.

The dorsal and palmar (Fig. 10, *B*) surfaces are large, the former contributing more to the back surface of the wrist than in any of the other carpal bones.

Of the Carpal Bones in Conjunction.—The proximal surface of the carpus of *Megalonyx,* as formed by the scaphoid, lunar, and cuneiform bones, presents a broad convexity interrupted between the two latter bones (Pl. VIII, Figs. 9, 11) by a deep gutter with irregular and perforated sides, which corresponds to the interval between the radius and ulna. The dorsal surface of the carpus is convex, and is most contributed to by the cuneiform, unciform, and pisiform bones. The palmar surface is concave, and is much deepened by the position of the pisiform bone.

In the radio-ulno-carpal articulation the same synovial sac appears to have existed between the radius and scapho-trapezium and lunare, and between the latter two bones, and a second sac appears to have been situated between the ulna, cuneiform, and pisiform bones. Between the two rows of carpal bones the synovial sac appears to have been continuous and to have extended downwards between the bones of the lower row, to be reflected throughout the carpo-metacarpal articulation.

Metacarpals.—Of metacarpal bones the collection of Dr. Owen contains the left index, both median, and the right annular; that of Jefferson the left index, median, and auricular; that of Col. Wailes, the left annular and auricular; and that of Dr. Dickeson the right index.

Of the metacarpals from that of the index finger to the last finger, the annular is the longest and the index the shortest; and the auricular, which is second in length, is the narrowest, whilst the median is the most robust.

The index metacarpal bone (Pl. X, Figs. 15, 16, 17), of Dr. Owen's collection, has an irregular cylindroid shaft, which, from the enlargement of the extremities, is longitudinally concave.

The proximal extremity (Fig. 16), is trilaterally prismoid, with the apex palmar and tuberous, the inner angle prolonged, and the base notched. Upon its carpal aspect it presents a nearly vertical, trilateral, sigmoid surface for articulating with the trapezoides. Its inner side exhibits a fan-shaped, concave facet (Fig. 15), continuous at an acute angle with the carpal articular surface, for junction with the median metacarpal; and its outer side (Fig. 17) presents another facet, also continuous with the carpal surface, demi-pyriform in outline and slightly convex, for articulating with the metacarpal of the thumb.

The distal extremity (Fig. 15) is composed of a long, vertical, ellipsoidal, articular process, with a vertical convex offset upon each side, for junction with the first phalanx. The outer articular offset is the larger, and above it there exists a strong ridge mounting to the summit of the articular process for ligamentous attachment.

On each side of the distal extremity a tuberosity exists for the attachment of the lateral ligaments.

	Inches.
Length	$3\frac{3}{4}$
Circumference of shaft	$3\frac{3}{4}$
Depth of proximal extremity	$1\frac{3}{4}$
Depth of distal extremity	2

Cuvier was misled by comparison of the index metacarpal of the *Megalonyx* with the metacarpals of neighboring genera of animals, to consider it as that of the annular finger,[1] although its exact adaptation to the radial side of the median metacarpal had previously led him to indicate its true position.[2]

The specimen of an index metacarpal, in the collection of Jefferson, is shorter and relatively more robust than that described; and the articular facets of its proximal extremity differ a little in form. The surface for the trapezoides is more depressed, and its outer angle more prolonged. The facet for the median metacarpal is more concave; and that for the metacarpal of the thumb is narrower, more regularly demi-pyriform, and is slightly depressed.

	Inches.
Length	$3\frac{1}{4}$
Circumference of shaft	$3\frac{3}{4}$
Depth of proximal extremity	$1\frac{3}{4}$
Depth of distal extremity	2

The index metacarpal, in Dr. Dickeson's collection, is almost equal in size to that first described, but its shaft is more cylindroid. The carpal articular facet is intermediate in the depth of its concavity to that of the above two specimens, and its outer angle is more prolonged than in either. The contiguous metacarpal facets have almost the same outline, but are nearly planes.

	Inches.
Length	$3\frac{1}{2}$
Circumference of shaft	$3\frac{1}{2}$
Depth of proximal extremity	$1\frac{3}{4}$
Depth of distal extremity	$1\frac{3}{4}$

The diaphysis of the median metacarpals (Pl. X, Fig. 2, 6, 13, 14), of Dr. Owen's collection, is quadrilateral. The dorsal side (Fig. 6) is broadest, and the palmar and inner sides, which are nearly equal, are narrowest. Antero-posteriorly the surfaces are more or less concave, that on the palmar aspect being most so. The inner side, just in advance of its middle is crossed by a tuberous ridge, which also extends to the distal articulation.

The proximal extremity (Fig. 13) is pyramidal, with the apex, which is downward, obliquely truncated, the base deeply excavated, and the outer side deeply grooved. The carpal articulation is trilobed, with the odd lobe downward. Vertically,

[1] Ossemens Fossiles, VIII, 320. (4th Ed.)

[2] Annales du Mus. d'Hist. Nat., V, 367.

in the middle it is convex, but between the dorsal pair of lobes is concave. The lower lobe and portions of both the upper articulate with the os magnum. The remaining but large portion of the inner lobe is bent forward and articulates with the unciforme, whilst the remainder of the outer lobe articulates with the trapezoides. From the articulation for the unciforme, a large surface (Fig. 14) extends to nearly the middle of the inner side of the diaphysis, for junction with the annular metacarpal; and from the articulation of the trapezoides, a convex, trilateral surface (Fig. 2) extends upon the outer side, for junction with the index metacarpal.

The distal extremity (Figs. 2, 6) of the bone is constructed after the same plan as that of the index metacarpal, but the inner offset of the articulation is reduced to a short tuberosity, which is continuous above with the ridge for ligamentous attachment.

	Inches.
Length obliquely	$4\frac{1}{4}$
Breadth of shaft dorsally	$1\frac{3}{4}$
Depth of shaft at middle	$1\frac{1}{4}$
Depth of proximal extremity	$2\frac{1}{4}$
Depth of distal extremity	$2\frac{1}{2}$

The median metacarpal bone, in the collection of Jefferson, is shorter than that just described, and nearly resembles it in detail, except that its distal articular process possesses a well developed offset upon the inner side.

	Inches.
Length obliquely	4
Breadth of shaft dorsally	$1\frac{1}{2}$
Depth of shaft at middle	$1\frac{1}{4}$
Depth of proximal extremity	$2\frac{1}{4}$
Depth of distal extremity	$2\frac{1}{2}$

The annular metacarpal bone (Pl. X, Figs. 6, 11), of Dr. Owen's collection, the longest of the series, has a cylindroid shaft with a superficial, acute, dorsal ridge.

The proximal extremity (Fig. 11) is bevelled off on each side, and in outline is irregularly pyramidal with the apex protuberant and downward, and the base elevated into a curved ridge. Its articular facets, which are continuous, consist of a reniform surface for the auricular metacarpal, and a vertical sigmoid surface, directed inwardly, for junction with the unciforme and the median metacarpal.

The distal extremity forms a long, vertical, elliptical, articular process with an offset at its outer inferior part, and a prominent marginal ridge ascending from the latter, and descending almost two-thirds the length of its inner side.

	Inches.
Length obliquely	5
Circumference of shaft	$3\frac{1}{2}$
Depth of proximal extremity	$2\frac{1}{4}$
Depth of distal extremity	$2\frac{1}{2}$

The annular metacarpal, in Col. Wailes' collection, is somewhat mutilated, but it appears to have corresponded pretty closely with that above described.

The auricular metacarpal bone (Pl. X, Figs. 18, 19), in the collection of Jefferson, has a cylindrical shaft, which expands most posteriorly.

The proximal end is irregularly pyramidal with the base outward, and with the apex tuberous. The outer side (Fig. 19) presents a slightly concave reniform facet for junction with the annular metacarpal, and the inner side is marked by a conspicuous discoidal surface of attachment for the internal carpo-metacarpal ligament. The carpal aspect presents a reniform, bent, articular surface bounded above by a thick rough ridge. The upper portion of this surface is for junction with the unciforme, and that below and internally is for the cuneiforme.

The distal end is formed by a vertically oblong process with an anterior, convex, articular facet, bounded by a thick, obtuse ridge (Fig. 19).

	Inches.
Length obliquely	$4\frac{3}{4}$
Circumference of shaft at middle	3
Depth of proximal end	$1\frac{3}{4}$
Depth of distal end	$1\frac{3}{4}$

The auricular metacarpal bone of the *Megalonyx*, Cuvier at first mistook for the annular metacarpal,[1] and was subsequently misled to view it as belonging to the index finger.[2] These mistakes probably arose from the examination only of a cast of the bone, in which the discoidal surface for the attachment of the internal carpo-metacarpal ligament could not well be distinguished from an articular facet.

The auricular metacarpal in the collection of Col. Wailes is broken, but when perfect, it appears to have been exactly like that above described.

Phalanges.—Of first phalanges, the collection of Dr. Owen contains an index, both median, and one annular; that of Jefferson, a median; that of Col. Wailes, the index, median, and annular of the left hand; and that of Dr. Dickeson, an index and a median.

The first phalanges (Pl. X, Figs. 3, 7) are deeper than they are long, and are curved pyramidal, with a rounded apex above and a transversely concave base below.

The proximal or metacarpal articulation is a deep, vertical concavity, extending from top to bottom of the bone, with an offset on each side inferiorly in the median phalanx, but on one side only in the annular and index phalanges.

The distal articulation consists of a trochlea, composed of two vertical, conjoined convexities projecting from the anterior aspect of the bone, bounded above and below by a concave surface, to increase the extent of flexion and extension of the second phalanges.

Of the three first phalanges indicated, the median is the largest, whilst the other two are nearly equal in size.

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[1] Annales du Mus. d'Hist. Nat., V, 369.

[2] Ossemens Fossiles, VIII, 302. (2d Ed.)

	Collection. Owen's. Lines.	Jefferson's. Lines.	Wailes'. Lines.	Dickeson's. Lines.
Depth of index first phalanx (middle)	25		23	23
Length of index first phalanx (side)	19		16	16
Breadth of index first phalanx (base)	21		18	17
Depth of median first phalanx (middle)	27	26	26	28
Length of median first phalanx (side)	20	15	17	16
Breadth of median first phalanx (base)	26	23	21	21
Depth of annular first phalanx (middle)	24		25	
Length of annular first phalanx (side)	18		16	
Breadth of annular first phalanx (base)	19		18	

Of second phalanges, the collection of Dr. Owen contains those of the index, median, and annular fingers of one side; the collection of Col. Wailes contains the same three bones; that of Jefferson the index and annular phalanges; and that of Dr. Dickeson, an annular phalanx.

The annular phalanx is the longest of the three mentioned, but the median (Pl. X, Figs. 4, 8) is the most robust, and is the second in length, while the index is, relatively to its length, more robust than the annular.

The shaft of the second phalanges (Figs. 4, 8) is demi-cylindroid, being flattened below; and it is longitudinally concave above, but is most so below, from the expansion in the same direction of the extremities.

The proximal phalangial articulation consists of two vertical concavities, separated by a median ridge terminating in tubercular extremities.

The distal phalangial articulation is formed of two convex condyles united in the form of a trochlea. The groove of the latter is bounded above and below by a fossa, to accommodate the last phalanges in their movements. The exterior sides of the condyles are depressed, and are bounded postero-superiorly by an oblique ridge for the attachment of lateral ligaments.

	Collection. Owen's. Lines.	Jefferson's. Lines.	Wailes'. Lines.	Dickeson's. Lines.
Length of index second phalanx (side)	28	27	29	
Depth (proximally) of index second phalanx (side)	25	24	22	
Depth (distally) of index second phalanx (side)	15	17	16	
Length of median second phalanx (side)	30		33	
Depth (proximally) of median second phalanx (side)	24		23	
Depth (distally) of median second phalanx (side)	19		20	
Length of annular second phalanx (side)	32	32	37	35
Depth (proximally) of annular second phalanx (side)	21	22	21	20
Depth (distally) of annular second phalanx (side)	18½	17½	17	19

Of the last or claw phalanges, the collection of Dr. Owen contains those of all the fingers except the thumb; that of Col. Wailes, those of the middle three fingers; that of Jefferson, those of the thumb, median, and annular fingers; the specimen from the cabinet of the New York Lyceum of Natural History, is of the median finger; and the collection of Dr. Dickeson contains an index and a median ungual phalanx.

The ungual phalanges (Pl. X, Figs. 5, 9, 10, 20) consist of a curved, laterally compressed, claw-process, enveloped at the posterior half or two-thirds with a bony sheath rising from an oblong tuberosity on the under border of the claw-process.

The articulation of the last phalanx consists of two vertical concavities separated by an intervening ridge; and its upper part projects a considerable distance posterior to the lower, or, in other words, overhangs it.

The claw-process at its upper margin, first obtuse, after a short distance in advance of the sheath, becomes acute. Its sides are nearly vertical; and they present beneath the sheath an arborescent vascular channel, which proceeds from an oval foramen piercing each side of the tuberosity from whence springs the sheath. Towards the end of the claw-process its surface becomes more and more perforated; and it presents numerous fine, reticular, vascular channels, for accommodating the nutritious vessels of the nail.

The sheath for the reception of the root of the nail is attached around the margin of the articulation, and to the sides of the tuberosity on the under part of the claw-process. Its outer surface is roughened and is perforated for the passage of vessels.

The tuberosity for the attachment of the sheath, is most prominent near its middle, posteriorly is perforated by the two, large, oval foramina above mentioned, and anteriorly is impressed on each side with a broad surface for attachment of the flexor tendons. From the anterior part of the tuberosity, an abutment springs forth to support the claw process.

Of the ungual phalanges, that of the median finger (Figs. 5, 9, 10) is the longest and largest, those of the index and annular fingers are next, and are nearly equal in size, and that of the auricular finger is the smallest. What I have taken for the last phalanx of the auricular finger may, however, belong to the hind foot, a fact which I have no certain means of ascertaining.

	COLLECTION.			
	JEFFERSON'S.	OWEN'S.	DICKESON'S.	WAILES'.
	Inches.	Inches.	Inches.	Inches.
Length of first ungual phalanx	$3\frac{1}{2}$			
Greatest depth of first ungual phalanx	$1\frac{3}{4}$			
Length of second ungual phalanx		6	6	$6\frac{1}{2}$
Depth of second ungual phalanx		$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
Length of median ungual phalanx	7	7	7	7
Depth of median ungual phalanx	3	$3\frac{1}{4}$	3	3
Length of fourth ungual phalanx	6	$5\frac{3}{4}$		6
Depth of fourth ungual phalanx	$2\frac{1}{4}$	$2\frac{1}{2}$		$2\frac{1}{4}$
Length of fifth ungual phalanx		$2\frac{1}{2}$		
Depth of fifth ungual phalanx		$1\frac{1}{2}$		

Femur.—(Pl. XI, Figs. 1, 2, 3.) The thigh bones of *Megalonyx*, preserved in the collection of Dr. Owen, in form are more like those of the Ai than of *Mylodon*, but they are relatively very much shorter than in the former animal, and more antero-posteriorly compressed and broader.

The front of the shaft (Fig. 1) is nearly flat, being slightly concave in the length and slightly convex transversely. Its upper half is marked by two vertical ridges

for muscular attachment. The back of the shaft (Fig. 2) is more convex, and is especially prominent at the middle. The inner margin is longitudinally concave and obtuse; and about three inches below the head of the bone it forms an oblong and very rugged tuberosity corresponding to the trochanter minor. The outer margin is nearly straight, and is thin and subacute, except at the extremities and at the middle, in which last position it forms a thick, oblong tuberosity. Its upper end constitutes a huge trochanter major, the antero-external surface of which is convex and rugged, and its posterior surface is excavated into a deep pit.

The head of the bone is hemispherical and sessile, but comparatively is more prominent than in the Ai. The trochlea (Figs. 1, 3) for the patella is a transversely oblong quadrilateral surface, which is concave from side to side and convex downward. It inclines slightly outwardly, and measures four inches in breadth, by nearly two in depth.

The condyles (Figs. 2, 3) are separated by a wide notch expanding above posteriorly, and to the margin of the trochlea inferiorly. They are directed downward and backward; and that external is isolated from the trochlea, while that internal is connected with it only by a narrow isthmus-like prolongation. The articular surface of the outer condyle is pentahedral, is nearly straight transversely, and is convex from before backward; and it inclines towards the other. The internal condyle resembles the segment of a sphere prolonged anteriorly to join the trochlea for the patella. The external condyloid process is formed by the expansion of the outer margin of the shaft into a strong tuberosity, the lower face of which is broad and irregular for the attachment of the corresponding lateral ligament. The internal condyloid process is a stout tuberosity placed above the condyle antero-internally and terminating in a broad surface of attachment for the internal lateral ligament.

	Inches.
Length of the femur	21½
Breadth obliquely from the head to trochanter major	10
Breadth at middle of shaft	7
Breadth at condyloid processes	10
Breadth at articular surfaces of the condyles	8½

The specimen of a right femur, in the collection of Col. Wailes, has the same form and proportions as those above described, but is smaller.

	Inches.
Length	20½
Breadth at middle of shaft	6

Tibia.—(Pl. XI, Fig. 4; Pl. XII, Figs. 1, 2, 3, 4.) The tibiæ in Dr. Owen's collection are quite perfect. They are relatively very much shorter than those of recent sloths, but are of greater relative length than those of *Mylodon*, to which they bear considerable resemblance of form.

The shaft is prismoid, and rapidly expands towards its extremities. The antero-internal face (Pl. XII, Fig. 1) forms a nearly vertical plane, about three inches

wide at the middle, and expanded above and below. The outer and posterior surfaces (Pl. XII, Figs. 2, 3) are longitudinally concave, but transversely are convex.

The head of the bone (Pl. XI, Fig. 4) presents the two femoral articular surfaces separated by an uneven tract expanding anteriorly upon a broad, perforated convex surface partially forming the upper part of the tuberosity for the ligament of the patella. The inner articular surface is an oblique, irregularly oval concavity rising at its anterior extremity into an angle of about 45°, and measuring in its long diameter four inches, and in its short diameter three inches. The outer articular surface is a trilaterally oval, inclined plane, three and a quarter inches broad and three inches antero-posteriorly; and it is continuous posteriorly with a nearly vertical convex, oval facet for conjunction with a sesamoid bone.

The tuberosity for the insertion of the ligament of the patella is a prominent convexity surmounting the acute outer margin of the bone, and forming the termination of a gradually expanding crest, which proceeds along the upper border of the antero-internal face.

The portion of the tibia which supports the articular surface for the outer condyle of the femur, rises in the form of a strong abutment from its posterior surface. It also supports the superior fibular articular surface, which is an elliptical plane two and a half inches long and one and a third wide, directed downward and outward.

The distal end of the tibia is narrower than the proximal end. The articular surface for the astragalus (Pl. XII, Fig. 4, *b*) is a transversely, oblong quadrilateral concavity, measuring three and a half inches wide and two and three quarters antero-posteriorly. At the middle anteriorly it is bounded by a short pyramidal process which fits into a corresponding fossa of the astragalus; and externally it is continuous at an obtuse angle with a trilateral plane for articulation with the fibula. (Fig. 4, *a*.)

The inner malleolus is a prominently convex tuberosity terminating the outer border of the bone, and supporting posteriorly a conspicuous trochlear process, the groove of which is directed downward and forward.

	Inches.
Length of the tibia at its antero-external surface	12
Greatest length, which is from the contiguous margins of the femoral articular surfaces to the trochlear process of the malleolus	15
Greatest breadth of head	$8\frac{1}{2}$
Antero-posterior diameter at middle of the head	$5\frac{1}{2}$
Greatest breadth of tarsal end	$6\frac{1}{2}$
Antero-posterior diameter	$3\frac{1}{2}$

Patella.—(Pl. XI, Figs. 5, 6.) The patellæ of *Megalonyx*, in Dr. Owen's collection, present nearly the same form as in *Mylodon;* being trilateral with rounded angles, the base upward and the apex downward.

The base is thick, rough, and perforated. The apex is tongue-like in form, and curved inwardly; and it measures two inches and a half in length from the femoral articular surface. The latter (Fig. 6) is transversely elliptical and convex, and

measures four and a half inches transversely by two in depth at the middle. The outer surface (Fig. 5) of the bone is slightly convex and roughened with longitudinal ridges.

	Inches.
Length of the patella	5
Breadth of its base	4

Tarsus.—Of the tarsal bones Dr. Owen's collection contains the astragalus and calcaneum of both sides, and the left scaphoid, and the right cuboid and external cuneiform bones.

Astragalus.—(Pl. XII, Figs. 7, 8, 9, 10.) The astragalus of *Megalonyx* bears much more resemblance to that of the recent sloths than of any other of the extinct ones. It may be described as consisting of two portions, one of which is quadrate and articulates with the bones of the leg, while the other is an ovoidal apophysis projecting antero-internally as in the Ai, and Unau, but relatively to a much less degree.

The quadrate portion of the astragalus its whole extent superiorly supports the tibial articular surface (Fig. 7), which antero-posteriorly is convex and transversely nearly a plane; and it measures four inches and three-quarters in the curve and three inches and a quarter in breadth. The anterior border presents a deep angular emargination verging upon a concave fossa, which accommodates a corresponding process of the tibia. The posterior border is narrow, and forms also the limit of the inferior surface of the bone. The outer side is a demi-crescentic, vertical, slightly convex, articular surface (Fig. 10, *a*) for the fibula. This surface is continuous at right angles with that for the tibia; and it measures three and a half inches antero-posteriorly and two inches at its deepest part, which is anteriorly. The inner side of the astragalus presents an uneven surface for ligamentous attachment. The under side of the quadrate portion supports the larger calcanean articular facet (Fig. 8), which is trilateral, slightly concave transversely, convex antero-posteriorly and internally, and nearly a plane in the same direction externally.

The ovoidal apophysis forms anteriorly a deep, concave, articular surface (Fig. 9), which extends upon the wide convex border beneath, for conjunction with the scaphoid bone. The outer and broader continuation of the convex border of the apophysis articulates with the cuboid bone (Fig. 10, *b*); and the under side of the apophysis presents a quadrilateral surface (Fig. 8), which is nearly a plane, for articulation with the calcaneum.

The two calcanean articular surfaces are separated by a deep interarticular gutter (Fig. 8), expanding on the inner and outer sides of the astragalus. The posterior surface is about three times the area of the other, and it measures about three inches transversely by two antero-posteriorly where broadest.

	Inches.
Greatest antero-posterior diameter of astragalus	$5\frac{1}{4}$
Greatest transverse diameter	$3\frac{3}{4}$
Greatest depth externally	$2\frac{1}{4}$

The specimen of an astragalus described and referred by Professor Owen to the *Megalonyx Jeffersonii*,[1] most probably also belongs to the *Gnathopsis Oweni*, indicated on page 14 of this monograph.

Os Calcis.—(Pl. XII, Figs. 5, 6.) The calcaneum is remarkable for its extraordinary expansion, which gives to the bone very much the appearance of an os ilium of some smaller animal. Its articular extremity is formed by an abrupt widening and decrease in depth of the anterior part, where it supports three facets (Fig. 6), separated by a trifurcate groove. The largest facet is supero-internal and trilaterally ovoidal (a), and articulates with the astragalus. Of the other two facets, which are nearly equal in size and irregularly ovoidal, that inferiorly (b) articulates with the astragalus, and that externally (c) with the cuboid bone.

Posterior to the articular extremity, the calcaneum (Fig. 5) forms a large plate nine inches in depth, and only a fourth of an inch in thickness towards the centre. Its posterior margin is thick, strong, rugged, and convex, and measures fifteen inches in its curvature. The extremities of this margin form convex tuberosities, of which that inferiorly is much the larger. Above the inferior one, externally, is a third tuberosity, which is strong and prominent.

The outer surface of the calcaneum is concave antero-posteriorly, but in the vertical direction is convex below and concave above. The inner surface is concave both antero-posteriorly and vertically.

The superior margin of the calcaneum is acute, and curves forward and outward, to terminate above the cuboid articulation in an obtuse prominence. The inferior margin is thick and convex; expands forward; and antero-posteriorly forms a deep concavity. The greatest antero-posterior diameter of the calcaneum is nine and three quarter inches.

Os Cuboides.—(Pl. XIII, Figs. 4, 5, 6.) The cuboid bone is irregularly cuboidal, and it presents large, quadrilateral dorsal (Fig. 4), and plantar surfaces for ligamentous attachment. Posteriorly it has a convex facet for articulating with the os calcis, and anteriorly it is perforated and roughened for ligamentous attachment. Internally a large concave facet (Fig. 6) exists for articulation with the astragalus, continuous with a second facet upon the antero-external margin of the bone, for articulating with the scaphoides. By the prolongation of this articular surface upon the supero-external angle anteriorly, a third facet is formed to join the cuneiforme externum. Externally the cuboides presents a large, trilateral, slightly convex surface (Fig. 5), the half of which posteriorly articulates with the fifth metatarsal bone, the remaining portion with the fourth.

	Inches.
Greatest antero-posterior diameter of the cuboid bone	$2\frac{1}{4}$
Greatest transverse diameter	2
Greatest height	$2\frac{1}{2}$

Os Scaphoides.—(Pl. XIII, Figs. 7, 8.) The scaphoid bone is a thick quadrilateral plate with convex margins. Its posterior surface (Fig. 7) is occupied with

[1] Zool. Voy. Beagle, Pt. I, 94, 98, 99; Mem. on the Mylodon, 133, Pl. xviii, Figs. 5 and 6.

the articulation for the apophysis of the astragalus, and is formed by a broad conical prominence bounded below by a deep, crescentic concavity. The anterior surface (Fig. 8) presents a pair of vertically oblong, articular facets, separated by a shallow gutter, of which the outer one joins the external cuneiform bone, the inner the contiguous cuneiform bone.

	Inches.
Greatest vertical diameter of scaphoid bone	$3\frac{1}{2}$
Greatest transverse diameter	$2\frac{3}{4}$
Greatest antero-posterior diameter, from the summit of the articular cone posteriorly	$1\frac{3}{4}$

Os Cuneiforme Externum.—(Pl. XIII, Figs. 1, 2, 3.) The external cuneiform bone is the smallest of those of the tarsus which have been described. It is irregularly, flattened pyriform, with its dorsal extremity (Fig. 1) thickest and broadest. Posteriorly (Fig. 3), it presents a vertical, concave facet, extending the depth and breadth of the bone, to articulate with the scaphoides, and this facet is joined at an obtuse angle supero-externally by a small one for the cuboides. Anteriorly (Fig. 2), the external cuneiform bone is occupied by a vertical, convex facet, constricted at the middle and broadest above, for articulation with the third metatarsal bone.

	Inches.
Greatest depth of external cuneiform bone	3
Greatest breadth	2
Greatest antero-posterior diameter, superiorly	$1\frac{1}{4}$

Metatarsus.—Of metatarsal bones, there are in the collection of Dr. Owen, a second of one side, and the fourth and fifth of both sides. Of the three bones indicated, the second is the shortest and the fifth the longest.

The second metatarsal bone (Pl. XIII, Figs. 9, 10, 11) has a trilateral diaphysis with the dorsal surface broadest and most deeply concave antero-posteriorly.

The proximal extremity (Fig. 11) is triangular, the angles being tuberous and prominent. The tarsal articulation is concave, but which bone it especially joins I have not the materials to ascertain. The inner angle internally is furnished with an oblique, oval, slightly concave facet (Fig. 9), for articulation with the first metatarsal, and the outer angle externally presents a circular, nearly plane surface (Fig. 10), for junction with the third metatarsal.

The distal extremity (Fig. 9) of the bone is constructed after the pattern of that of the metacarpals, consisting of a long, vertical, ellipsoidal, articulating process, with a short vertical offset upon each side.

	Inches.
Length of second metatarsal bone	$3\frac{1}{2}$
Breadth of the diaphysis	$1\frac{1}{4}$
Depth of the proximal end, from the inferior angle to the middle of the base of the triangle	$2\frac{1}{4}$
Depth of the distal articulation	$2\frac{1}{2}$

The fourth metatarsal bone (Pl. XIII, Figs. 12, 13, 14, 14*) has a cylindroid

shaft, deeply concave antero-posteriorly above and below, but most so in the latter position.

The proximal extremity (14*, *the figure is reversed*) is quadrilateral with the lateral sides longest and the lower side shortest. It is bounded above by a thick transverse ridge, and inferiorly forms a prominent pyramidal tuberosity. The tarsal articulation (Fig. 14*) consists of a single, vertically oblong quadrilateral plane, for junction with the cuboides. The outer side (Fig. 14) presents a large, quadrilateral plane, continuous with the cuboid articulation and prolonged at its postero-inferior angle, for junction with the fifth metatarsal. The inner side (Fig. 13), at its upper part, supports a transversely elliptical, convex facet for articulation with the third metatarsal.

The distal extremity is constructed like that of the bone last described, except that no articular offset exists upon the outer side.

	Inches.
Length of fourth metatarsal bone	$4\frac{1}{2}$
Circumference of the diaphysis	$4\frac{1}{4}$
Height of the proximal extremity	$2\frac{1}{2}$
Height of distal extremity	$2\frac{1}{2}$

The fifth metatarsal bone (Pl. XIII, Figs. 15, 16) is quite peculiar in its form, arising chiefly from a huge process projecting obliquely outward and backward from the carpal extremity of the normal diaphysis. Viewed as a whole, it is triangular with the angles tuberous, the margins concave, and the dorsal and plantar surfaces concave and shelving forward and outward.

The normal diaphysis is compressed cylindroid, with an acute outer and a convex inner border.

The lateral process is stronger and broader than the diaphysis of the bone, and is about the same length. Its extremity forms a convex tuberosity, and inferiorly also presents a pair of low, rough tuberosities.

The tarsal extremity of the bone presents two, irregularly semicircular, vertical, slightly concave facets, conjoining at an acute angle. The tarsal facet (Fig. 16) articulates with the cuboides; the other one joins the fourth metatarsal bone.

The distal extremity of the bone forms a large convex tuberosity, supporting a single, elliptical, convex, articular facet for the first phalanx.

	Inches.
Length of the fifth metatarsal bone, from the angle formed by the articular facets of the tarsal extremity to the distal end	$3\frac{3}{4}$
Length from angle formed by the articular facets of the tarsal extremity to the lateral process	$3\frac{3}{4}$
Depth of tarsal extremity	2
Depth of distal extremity	$1\frac{3}{4}$
Width of shaft anterior to the lateral process	$1\frac{1}{2}$
Width of lateral process	2

Phalanges.—Of phalanges of the hind foot of *Megalonyx*, the collection of Dr. Owen contains the homologue of the first and second of the middle toe; the last

of the same toe and of the second or fourth toe of both feet; and the first of the last toe.

In the third or median toe the homologues of the first and second phalanges form a single bone (Pl. XIII, Figs. 17, 18), which is short and very robust. Its shaft is quadrate, and decreases in diameter anteriorly. The proximal articular surface, as in the first phalanges of the forefeet, presents a deep, vertical concavity, with an oblique offset on each side inferiorly. The distal extremity like that of the second phalanges of the forefeet, forms a trochlea, the median groove of which is bounded above and below by a fossa, to accommodate the movements of the last phalanx. The sides of the trochlea are plane, but are deepened towards the centre, just posterior to which is a tuberosity for the attachment of the lateral ligament.

	Inches.
Length of the homologue of the first and second phalanges of the middle toe, laterally	$3\frac{1}{2}$
Depth of proximal extremity	$3\frac{1}{4}$
Depth of trochlear extremity	2

The last phalanx of the third toe (Figs. 19, 20), is like that of the corresponding toe of the forefoot, but is very much larger and stronger. Its measurements are as follows:—

	Inches.
Length in straight line	$8\frac{1}{4}$
Greatest depth	$4\frac{1}{2}$

The last phalanx of the second or fourth toe (Fig. 21), is like those of the corresponding toes of the forefeet.

	Inches.
Length	$6\frac{1}{2}$
Depth	3

The first phalanx of the last toe is a quadrilateral nodule, with a concave metacarpal facet, and a small, oblong, convex facet for the next phalanx.

	Inches.
Length	$\frac{3}{4}$
Breadth	1
Depth	$1\frac{1}{2}$

The two ungual phalanges of the hind foot of a young individual of *Megalonyx Jeffersonii*, in the collection of the Academy of Natural Sciences, and forming part of the specimens upon which Dr. Harlan proposed the *M. laqueatus*, are interesting as indicating the mode of their development.

One of the specimens belongs to the median toe, and the other to either the second or the fourth toe.

In the median ungual phalanx, the line of separation of the articular epiphysis is indicated by a fissure still existing at the lower third of the bone; and in the other ungual phalanx the articular epiphysis is yet separable. In the former specimen, the ungual sheath is broken away except at its attachment to the tubero-

sity at the bottom of the claw-process, but in the other specimen upon one side it remains entire. In this the lateral portion of the ungual sheath is in the form of an oval disk, with thin edges, attached below to the basal tuberosity. Its outer surface is convex and perforated; and its posterior edge is unattached to the articular margin of the bone, indicating that the latter obtains its full development of length before the ungual sheath incloses entirely the root of the nail.

The two large vascular foramina of the basal process in the mature phalanges, in both young specimens are in the form of notches continuous with the separation of the ungual sheath from the articular margin of the epiphysis.

The nail which is preserved on the smaller of the specimens of the two phalanges, is brown in color, is readily separable into its structural laminæ; and it has the same form as the claw-process, except that its lower margin is grooved as in the nails of the recent sloths.

Megalonyx dissimilis, Leidy.

The collection of Dr. Dickeson contains two specimens of teeth found in the ravines in the neighborhood of Natchez, Mississippi, which, though belonging to the genus *Megalonyx*, apparently do not belong to the same species as that just described. One of the teeth is a first molar, which I suspect to belong to the lower jaw, as the wearing of the triturating surface is different from that of the corresponding upper tooth of *Megalonyx Jeffersonii*. The other is probably a fifth molar of the upper jaw, and in the description will be so designated.

The specimen of the first molar (Pl. XIV, Figs. 4, 5) is two and a half inches long, but its lower part is broken away, and as the margin of the pulp cavity anteriorly measures two lines in thickness, when the tooth was perfect it probably was an inch or more longer. The bottom of the pulp cavity is twenty lines from the triturating surface, which, if we may judge from the first molars contained in the two skulls described of *M. Jeffersonii*, indicates the animal, at least, not to have been an old one. In transverse section (Pl. XVI, Fig. 8), the tooth is elongated elliptical, with the outer side convex, and the inner side concave with a median convex bulge. Its long diameter is seventeen lines, its short diameter seven and a half lines. The tooth is relatively less curved longitudinally than in the corresponding upper tooth of *M. Jeffersonii*. The triturating surface (Pl. XIV, Fig. 5) is worn into a deep concavity open to the bottom internally. Externally also the cementum is worn off a short distance from the harder dentine.

The structure of the tooth is the same as in the corresponding upper tooth of *M. Jeffersonii;* but the cementum and harder dentinal layer are thickest externally, and both together gradually become thinner to the middle line internally.

In Cuvier's plate of bones of the *Megalonyx*, in the Annales du Museum,[1] and in the successive editions of the Ossemens Fossiles,[2] is the representation of a trans-

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[1] V, Pl. xxiii.

[2] Ed. 3, Pl. xv.

verse section of a tooth, figure 13, which so closely resembles that of the tooth above described, that it might be readily taken for it, except it is larger. Cuvier never alludes to this figure, but in the references to Plate CCXVI, of the Atlas to the posthumous edition of the Ossemens Fossiles, it is stated that "la figure 13 est vraisemblablement la coupe horizontale de la dent précedente, pour montrer son épaisseur." This is most probably a mistake, for it is impossible that an outline like that of figure 13 could be produced from figure 14, which represents pretty correctly the first molar, most probably of the lower jaw, of *M. Jeffersonii.* Figure 13 I suspect was drawn from a distinct tooth, which was subsequently mislaid and forgotten. If, however, this view be incorrect, it must be acknowledged that the two figures above mentioned have no correspondence in form with each other, while they exhibit an extraordinary resemblance to distinct forms of teeth existing in nature, one of which had never been seen by the artist.[1]

The other tooth referred to as probably being a fifth upper molar (Pl. XIV, Figs. 7, 8) is compressed ovoidal in section (Pl. XVI, Fig. 15), instead of being trilateral as in the corresponding tooth (Pl. XVI, Figs. 9, 10, *a*) of *M. Jeffersonii.* Its long or transverse diameter measures ten lines, while its short or antero-posterior diameter is at the widest part five lines. The lower part of the tooth is broken away; and the bottom of the pulp cavity is ten lines from the triturating surface, which is worn into a concavity.

EREPTODON, Leidy.

Ereptodon priscus, Leidy.

The collection of Dr. Dickeson contains an isolated tooth, found in a ravine in the neighborhood of Natchez, Mississippi, which has about the same size and structure as the first molar of the *Megalonyx Jeffersonii,* but has a very different form.

In relation to the position of this tooth in the jaw, in comparing it with the teeth of *Megalonyx,* it would appear to be a first molar, but compared with those of *Mylodon,* it appears as if it was rather a last inferior molar.

The specimen (Pl. XIV, Figs. 9, 10, 11) is an inch and eight lines long, and is excavated from the bottom for the dental pulp, to within seven and a half lines of the triturating surface. The border of the pulp cavity is broken away, and the tooth when perfect has probably been an inch longer.

In transverse section (Pl. XVI, Fig. 18), the tooth is elliptical, with a tortuous outline, and the posterior extremity is more obtuse than the anterior. Its long diameter is one inch and seven lines; its short diameter is eight and three-quarter lines.

The tooth is very slightly curved in its length (Pl. XIV, Fig. 11), and the triturating surface presents an irregular, antero-posterior concavity. The inner side

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[1] The figure 13 of Cuvier's plate is reproduced in figure 6, Plate lxxx, of Owen's Odontography; and also in figure 1, Plate xvii, of the Zoology of the Voyage of the Beagle, as characteristic of the *Megalonyx Jeffersonii.*

is convex and slightly impressed longitudinally at several points. The outer side is longitudinally fluted (Fig. 9), and in the specimen anteriorly it presents an irregular nodulated line apparently the result of disease in the dental pulp. The anterior border is narrow and smooth; and the posterior border is obtuse, and at the triturating surface is worn away for several lines.

As above mentioned incidentally, the molar tooth of *Ereptodon priscus* has the same structure as the teeth of *Megalonyx;* but a peculiarity observed in the specimen is the nearly uniform thickness of the harder dentine and cementum all round.

MYLODON, Owen.

Mylodon Harlani, Owen.

In the American Journal of Geology,[1] and subsequently in the Medical and Physical Researches,[2] Dr Harlan described and figured a fragment of the lower jaw of an extinct bradypoid animal, which he referred to the *Megalonyx laqueatus*, but Professor Owen[3] determined it to belong to the genus *Mylodon*, and dedicated the species to Dr. Harlan.

The specimen referred to belongs to the Cabinet of the Lyceum of Natural History of New York, and has been kindly loaned to me for examination. It was found at Big-bone-lick, Kentucky; and it is unchanged in texture. Its form (Pl. XIV, Figs. 1, 2) is like that of the corresponding portion of the lower jaw of the *Mylodon robustus*.

Within the first alveolus of the specimen is a small fragment of the appertaining molar, which, though mutilated is sufficiently perfect to indicate its form in transverse section. (Pl. XVI, Fig. 19, *a*.) This is reniform, with the long diameter antero-posterior, and measuring twelve and a half lines. The inner side is concave, and the outer one convex; and the short diameter of the tooth is about seven and a quarter lines.

The second molar in section (Pl. XVI, Fig. 19, *b*) is quadrate with rounded angles. Its postero-internal portion is most prominent, and its outer side is convex while the other three sides are concave. The antero-posterior diameter is eight and a half lines, and the transverse diameter ten lines.

The third molar (Pl. XVI, Fig. 19, *c*) is transversely oblong quadrilateral, with rounded angles. It is obliquely situated in the jaw; has the anterior and posterior sides concave, the outer one convex, and that internal nearly a plane. Its antero-posterior diameter is seven and a half lines; its transverse diameter fourteen lines.

The last tooth (Pl. XVI, Fig. 19, *d*) of the series is intermediate in form to that of *Mylodon robustus* and *M. Darwinii.* In transverse section it presents an irregular dumb-bell outline. The anterior lobe is most produced antero-externally, while that posterior is most produced postero-internally. Anteriorly the tooth is obliquely

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[1] I, 74, Pl. iii, Figs. 1, 2, 3.
[2] 334, Pl. xv, Figs. 2, 3, 4.
[3] Zool. of the Voyage of the Beagle; Foss. Mam., 68.

concave, posteriorly convex. The isthmus or intermediate portion connecting the lobes is only four and a half lines wide. The anterior lobe in its perfect condition was about fifteen lines wide, and that posterior about eleven lines.

The collection of Col. Wailes contains two fragments of a last molar tooth (Pl. XVI, Fig. 20) closely corresponding to that just described, found in Mammoth Ravine, Mississippi.

Professor F. S. Holmes, of Charleston, sent for my inspection a small fragment of a molar tooth of an extinct sloth-like animal, which had been discovered by Capt. Bowman, U. S. A., in the sands of Ashley river, South Carolina. The specimen, when first received, I supposed to indicate a species of a new genus, to which I gave the name of *Eubradys antiquus*,[1] but I now believe it to be nothing more than a fragment of the first inferior molar of *Mylodon Harlani.* It is represented in two views in Plate XVI, Fig. 21, *a*, *b*, and in transverse section in Fig. 21, *c*, which, by comparison with that of the first lower molar of *Mylodon Harlani*, Fig. 19, *a*, will be found to resemble a corresponding portion sufficiently to consider it as the same.

Dr. H. C. Perkins described a tooth and a humerus, found on the Willammette or Multonah river, a tributary of the Columbia, in Oregon,[2] which have been referred to the *Mylodon Harlani*, by Professor Owen.[3]

Dr. Harlan subsequently described, and gave figures of a number of bones and teeth of an extinct bradypoid animal, which were found by Mr. Koch, in association with remains of *Mastodon*, etc., in Benton Co., Missouri.[4] These, Dr. Harlan referred to a new genus and species under the name of *Orycterotherium Missouriense*,[5] but Professor Owen, who had an opportunity of inspecting the specimens, satisfactorily determined them to belong to *Mylodon Harlani.*[6]

The Cabinet of the Academy of Natural Sciences contains a humerus, with its distal end and anterior portion of the upper half broken away, which I suppose to belong to the *Mylodon Harlani.* (Pl. XIV, Fig. 3.) It was found at Big-bone-lick, Kentucky, and was presented to the Academy by John P. Wetherill, Esq. The specimen is an adult one, and in its details of form agrees pretty closely with the corresponding bone of *Mylodon robustus;* and its measurements accord with those of the Oregon specimen described by Dr. Perkins.

The collection of Dr. Dickeson, deposited in the Academy of Natural Sciences, contains a number of bones of a half grown individual of *Mylodon Harlani*, which were discovered in association with remains of the *Megalonyx* and other extinct animals in the ravines in the vicinity of Natchez, Mississippi.

The bones have lost their epiphyses, but the diaphyses are in a good condition of preservation, and remain unchanged in texture, except that they are infiltrated with oxide of iron.

The specimens are as follows:—

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[1] Proc. Acad. Nat. Sci., VI, 241; Ancient Fauna of Nebraska, 10. The word *Enbradys* given in the former instead of *Eubradys*, is a typographical error; and the synonyme to *Eubradys antiquus* in the latter work is an error resulting from its introduction in the wrong place.

[2] Am. Journ. Sci. and Arts, XLII, 136.

[3] Ibid., XLIV, 344.

[4] Ib., 69.

[5] Ib.

[6] Ib., 344.

The left half of the lower jaw preserved with all its teeth. The bone in its present condition measures ten inches from its posterior margin to the anterior mental foramen, which is placed an inch and a quarter in advance of the position of the first molar; and its depth below the third molar is about two and a half inches. Its form agrees with the corresponding portion of the jaw of *Mylodon robustus* but is more convex externally in accordance with its age. The teeth have the same form and proportions as those in the adult fragment of jaw above described, except that the first of the series in transverse section is more demi-oval than reniform, and the anterior side of the second tooth is a little convex instead of being a little concave.

The malar bone of the left side. It presents the same trilobate appearance as in *Mylodon robustus*.

Fourteen fragments of vertebræ.

The scapula of the right side. Its glenoid articulation and coracoid process have the same mode of development indicated in the account of the corresponding bone of the young skeleton of the *Megalonyx Jeffersonii*.

Both humeral diaphyses. These are nine and a half inches long, by seven and a half inches in circumference at the middle. The deltoidal tract already presents a prominent outline.

The right ulnar diaphysis, which is eight and a half inches long, and its lower third is six and a quarter inches in circumference. The coronoid process rises almost from its middle.

Both radial diaphyses. These are five and a half inches long, and four and a half inches in circumference about the middle.

One ilium, two ischia, and an os pubis.

Both femoral diaphyses accompanied by the head of one. Length of the diaphyses eleven inches; circumference about the middle ten inches.

A tibial and fibular diaphysis. The former measures four and three-quarter inches in length, and seven inches in circumference about the middle; and the latter is about the same length, and two and three-quarter inches in circumference at the middle.

MEGATHERIUM, Cuvier.

Megatherium mirabile, Leidy.

The most wonderful of all the extinct sloth tribe, the huge *Megatherium*, finally claims our attention. Its geographical range appears to have been equally extensive with that of the *Mylodon*, but I think it may be questioned whether the remains of this genus found in North and South America belong to the same species. In no other instance, so far as investigations have been carefully made, has any species of an extinct sloth been discovered common to the two American continents. Under these circumstances, until it shall have been proved to be otherwise the case by comparison of specimens or good figures, I propose to consider the North American *Megatherium* a distinct species with the name of *M. mirabile*, while the older name of *M. Cuvieri* appertains to the South American species.

I can find no authentic evidence that the remains of the *Megatherium* have been discovered in any other localities of North America, than the maritime portion of the state of Georgia, and upon the shores of the Ashley river, in South Carolina.

Dr. Harlan[1] states that he had found bones of the *Megatherium* in New Jersey, but as these have never been described nor since seen, it may be suspected that they turned out to be the remains of the *Mastodon.*

Dr. R. Haymond has published an account of a tooth discovered in Indiana, which he attributes to the *Megalonyx,* but the description evidently applies to the molar of an Elephant.[2]

The first authentic notice of the discovery of remains of the *Megatherium* in North America, was given by Dr. Samuel L. Mitchell, who described portions of two teeth of the animal from Skiddaway Island, Georgia.[3] Mr. William Cooper shortly afterwards described a collection of *Megatherium* remains obtained by Dr. Joseph C. Habersham, from the marshes of Skiddaway. The collection was deposited by Dr. Habersham in the cabinet of the Lyceum of Natural History of New York, and Mr. Cooper gives a list of the specimens of which it consists as follows:—

Four fragments of a lower jaw; fragments of three teeth; three vertebræ; fragments of three or four ribs; distal extremity of a humerus; two heads of the femur; and a number of other fragments, unsatisfactorily determined.[4]

Subsequently Mr. Cooper described some other remains of the *Megatherium* obtained by Dr. Habersham, among which, the most important were several fragments composing the co-ossified tibia and fibula, and a metacarpal bone.[5] The length of the co-ossified bones of the leg was a little over two feet, and the breadth at the middle a little over one foot.[6]

Mr. William B. Hodgson, in a "Memoir on the Megatherium, etc.,"[7] mentions other remains of the *Megatherium* discovered in Georgia. In a memorandum contributed to the memoir by Dr. Habersham, this gentleman gives the following list, with measurements, of bones of the *Megatherium* in his possession, and obtained from Skiddaway Island.[8]

Posterior portions of two skulls, of which the more perfect measures ten and a third inches between the external auditory meatuses.

Six large molar teeth, measuring one inch and four-tenths to one and eight-tenths in their greater diameter, and one inch and three-tenths to one and six-tenths in their smaller diameter.

A first upper molar tooth; the fragment of a lower jaw; several dorsal vertebræ; fragments of ribs and of a pelvis; a broken clavicle; and a metacarpal bone nine inches long.

Two heads of the humerus, five and a half inches in diameter, and two distal extremities fourteen inches wide.

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[1] Am. Journ. Sci. and Arts, 1828, XIV, 187.
[2] Ibid., XLVI, 294.
[3] An. Lyc. Nat. Hist., 1824, I, 58.
[4] Ibid., 114.
[5] Ibid., 1828, II, 267.
[6] Ibid., 269.
[7] New York, 1846.
[8] Skiddaway Island is situated on the coast of Georgia, and according to Mr. Hodgson, consists of a sandy, newer pliocene formation, rising but a few feet above high tide.

The head of a femur seven inches in diameter, and a distal extremity eleven inches wide; the upper and lower extremities of a tibia; an os calcis; an astragalus; an ungual phalanx, which, if perfect, would measure eleven inches in length; and fragments of several other phalanges.[1]

With the remains of the *Megatherium* given in this list, others were found of *Elephas primigenius, Equus Americanus, Bos latifrons*, and of a chelonian.

The remains of the North American *Megatherium*, which I have had the opportunity personally of examining, are those contained in the museums of the National Institute in Washington, and of the Academy of Natural Sciences of Philadelphia, besides several fragments of teeth loaned to me by Major Leconte of the latter city, and Professor Holmes, of Charleston.

The collection of *Megatherium* remains in the cabinet of the National Institute, were discovered in Skiddaway Island, and were presented by Drs. J. P. Scriven and Habersham. A few years since on a visit to Washington, through the aid of my friend Professor Baird, I was enabled to borrow a few of the more characteristic specimens of this collection consisting of a nearly entire lower jaw with the teeth, an isolated tooth, the temporal portion of a cranium, and an annular metacarpal bone. The other specimens observed in the collection with a few notes taken at the time are as follows:—

1. An axis, which measures five and one-third inches in length from the summit of the dentate process. The body posteriorly is three and a quarter inches in width and two and a half inches in depth. The anterior orifice of the spinal canal is cordiform, and a little over two inches in diameter. The anterior articular processes are pyriform in outline, and after advancing upon the dentate process become confluent inferiorly. The entire depth of the bone from the end of the spinous process is about seven inches; and the transverse processes measure an inch and three-quarters in length from the foramen for the vertebral artery, which is about seven lines in diameter.

2. A cervical vertebra, apparently the fourth, with a half oval body, anteriorly measuring two and a half inches in depth, and three and a quarter transversely. The spinal canal is trilateral, one inch and a half in depth, and two and a half inches transversely. The foramen of the transverse process is three-quarters of an inch in diameter.

3. Two bodies of cervical vertebræ, co-ossified by means of strong, irregular exostoses, which completely obscure their under part. One exostosis on the right side measures four and three-quarter inches in length, and is an inch in thickness. The two bodies are of the length of the exostosis just mentioned; and the anterior surface of the one is subcircular, and three and a quarter inches wide and three deep, while the posterior surface of the other is transversely oval, and is four inches in the long diameter, by three and a quarter in the short diameter. One remaining transverse process has its foramen nearly an inch in diameter.

4. The spinous process of a dorsal vertebra nine inches in length, with the

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[1] *Loc. cit.*, 25.

remains of the spinal arch four and a half inches in the span between the posterior articular processes.

5. Two fragments of ribs measuring three and a quarter and three and a half inches in breadth at the distance of six inches from the tubercle.

6. The head of a femur, six and a half inches in diameter at the base.

7. The proximal extremity of a tibia and a small fragment of a second. The shaft is prismoid, and at the distance of ten inches below the head of the bone is thirteen and a half inches in circumference. The head is ten and a half inches broad, and measures about half as much antero-posteriorly. As in *Megalonyx*, the femoral articular facets are separated from each other posteriorly by a concave notch, and partially overhang the posterior surface of the shaft. They are separated from each other by an interval of two and a half inches in width. The internal facet is oval, deeply concave, five and a half inches antero-posteriorly and obliquely, and four and three-quarter inches transversely. The outer facet is antero-posteriorly moderately convex, ovate in outline, five and three-quarter inches in its long diameter, and three and a quarter in its short diameter.

8. A mutilated os calcis; an occipital condyle three and a quarter inches in its long diameter, and two and a half in its short diameter; and several fragments of teeth.

Proceeding next with a description of the specimens of *Megatherium* remains borrowed from the National Institute collection, that of the temporal portion of a cranium consists of the temporal bone with contiguous co-ossified portions of the occipital and parietal bones (Pl. XV, Fig. 3); and it corresponds in form with the same part of the cranium of *Megalonyx*.

The temporal surface is strongly reticulated with ridges, and is pierced with numerous large vascular foramina. The parietes of the cranium in the position of the squamous portion of the temporal bone at their thinnest point are an inch and a half thick; and the cranial tables are occupied with a dense intervening diploic structure.

The lateral border of the inion is a thick obtuse ridge expanding below into the root of the zygomatic and mastoid processes. The zygomatic process has the same inclination of its root as in *Megalonyx;* and the mastoid process is relatively shorter, broader, and more rugged than in the latter animal.

Back of the mastoid process is a deep gutter descending from the margin of the inion above the process to the stylo-mastoid foramen.

The entrance of the external auditory meatus is nearly on the same plane with the outer surface of the zygomatic root, instead of being situated at the bottom of a wide arch as in *Megalonyx*. Its upper boundary is prominent and rough; and the auditory process is a thick, irregular ridge extending from the outer extremity of the glenoid articular cavity to the apex of the mastoid process. The meatus is demi-cylindroid in form and two inches in length.

The glenoid articular cavity is a deep, transversely oval concavity, measuring two and a half inches wide, and an inch and a half antero-posteriorly.

The specimen of a hard palate, from the National Institute collection, on its two sides gives the entire length of the upper molar series as eight inches. The width of the palate between the first pair of molar alveoli is thirty-four lines, and that

between the fifth or last pair of alveoli at their middle is thirty-two lines. The under surface of the hard palate is concave transversely, especially towards the extremities; is slightly convex antero-posteriorly, and is perforated with a great number of conspicuous foramina. Between the position of the last molar alveoli, large palatine canals commence at the termination of a larger channel proceeding on each side from the posterior extremity of the palate.

The antero-posterior measurements of the superior molar alveoli, so far as they can be ascertained from the specimen just described, are as follows :—

	Lines.
First molar alveolus	8
Second molar alveolus	16
Third molar alveolus	19
Fourth molar alveolus	19
Fifth molar alveolus	15

The lower jaw of the *Megatherium*, in the collection of the National Institute, is one of the most perfect and interesting specimens yet discovered in North America. It, I believe, was presented to the Institute by Dr. J. P. Scriven.

The base of the lower jaw (Pl. XV, Fig. 1) of *Megatherium*, on a line with the teeth, presents a remarkable convex extrusion to accommodate the extraordinary length of the latter, which, at their bottom, are only two or three lines from the exterior surface of the bone. The alveolar portion of the jaw is six inches in depth; and its outer side is convex and rough, and its inner surface nearly a vertical plane and smooth. The ramus externally and internally is roughened with ridges for the attachment of the powerful masseter and pterygoid muscles.

The alveolar border of the jaw occupies a tract which is seven and a half inches long, and two inches wide at the middle. The teeth are separated by intervals of about the fourth of an inch, gradually widening outwardly and inwardly; and they are exserted in a gradually increasing extent from behind forward; the last one being about four lines above the alveolar border internally, and the first one a little more than an inch.

The dental canal commences at the root of the coronoid process about two inches back of the last molar tooth; one of its branches opening exterior to the latter, and the other advancing towards the symphysis of the jaw.

The teeth contained within the lower jaw just described are perfect; and they are quadrilateral, curved columns with the angles rounded, the anterior and posterior surfaces convex, and the lateral surfaces forming planes. The triturating surfaces are worn into transverse, angular grooves, bounded before and behind with angular ridges. The measurements of the teeth are as follows :—

	Inferior Molars.			
	First.	Second.	Third.	Fourth.
Antero-posterior diameter	18 lines.	19 lines.	20 lines.	18 lines.
Transverse diameter	22 "	22 "	20 "	18 "
Length in the curve	7 inches.	7 inches.	7 inches.	6 inches.

The annular metacarpal bone, of the National Institute collection, is nine and a quarter inches long. Its shaft is quadrate, with the outer angles rounded, and the

inner ones acute and rugged. The proximal end is narrowed, and is nearly five inches in depth; and the distal end is longitudinally oval, and presents a single, vertical, articular convexity surrounded by a rugged border.

The collection of remains of the *Megatherium* in the museum of the Academy of Natural Sciences of Philadelphia, was presented to this institution by James Hamilton Couper, of Darien, Georgia. These remains have additional interest from the fact that they were obtained in a different locality from the others above described or particularly indicated. They were discovered in association with remains of *Elephas primigenius, Mastodon, Bison latifrons,*[1] *Equus Americanus, Chelonia Couperi, etc.,* in making the excavation of the Brunswick canal, which connects the Altamaha and Turtle rivers, in Georgia.[2]

Mr. Couper's specimens are as follows: A portion of the hard palate; a small fragment of the alveolar border of the face; the alveolar portion of the left side of the lower jaw containing all the teeth; an anterior dorsal vertebra with its spinous process lost; two bodies of other anterior dorsal vertebræ; bodies of two lumbar vertebræ; two proximal extremities of ribs; the proximal extremity of a humerus; and a lunar bone of the carpus.

The portion of the hard palate corresponds to the anterior four molar alveoli, and it belonged to a larger individual than the specimen above described, but otherwise does not differ from it. When adapted in proper position with the small fragment in the same collection, of the alveolar border of the face, the latter is estimated to have been about six and three-quarter inches wide at the middle pair of alveoli.

The fragment of a lower jaw containing the teeth also corresponds with the same portion of the specimen belonging to the National Institute.

The anterior dorsal vertebra has a trilateral body, the posterior face of which is four inches wide and three and three-quarters in depth. The spinal canal is transversely oval, and is three and a half inches wide and three deep. The spinal arch at the root of the spinous process is five inches in width antero-posteriorly. The transverse process is short, strong, and tuberous; and it presents a concave articular facet for the tubercle of the rib, and a second concave facet is situated at the side of the spinal arch for the head of the rib.

The two dorsi-vertebral bodies above mentioned correspond to that just described, and all three of them are about three and a quarter inches in length.

The two lumbar vertebral bodies are cylindroid, with dilated extremities, and are about four and a quarter inches long, and five in diameter at their articular surfaces, and their spinal canal is about two and a half inches wide.

The two proximal extremities of ribs are from the posterior part of the thorax; and their heads measure three inches in the long diameter.

The proximal extremity of the humerus in form resembles that of *Megalonyx*, but its tuberosities are unequal in size. The breadth of the fragment at the

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[1] The fragment of a lower jaw upon which Dr. Harlan founded the *Sus Americanus*, and Professor Owen, of London, the *Harlanus Americanus*, I find to belong to *Bison latifrons*. See Proc. Acad. Nat. Sci., 1854, VII, 89.

[2] The fossil bones were found at the bottom of an alluvial formation, between four and six feet below the surface, imbedded in a stratum of clay resting on yellow sand. Hodgson: Mem. on the Meg., 38.

tuberosities is eight inches; and the head of the bone is six inches in its long diameter, and five and a half in its short diameter.

The lunar bone is four and a half inches broad between the dorsal and palmar surfaces; and its radial articular surface is three inches wide, and five and a half in the curve antero-posteriorly.

The fragments of two teeth of *Megatherium*, loaned to me by Major Leconte, are from Skiddaway Island. One of them (Pl. XV, Fig. 4) is part of a third or fourth inferior molar, and measures eighteen lines antero-posteriorly and nineteen lines transversely. The other specimen is a longitudinal, anterior, or posterior fragment of the largest molar tooth of the *Megatherium* I have yet seen. It measures nearly two inches in transverse diameter, and may probably belong to the upper jaw.

The fragments of teeth of the *Megatherium* loaned to me by Professor Holmes, of Charleston, are two very small ones, from the shores of Ashley river, South Carolina, where they were discovered by Capt. Bowman, U. S. A., in association with remains of *Elephas, Mastodon, Equus, Tapirus, Dicotyles, Hipparion, Hydrochoerus,* etc., and are of no further interest than that they indicate a new locality for the *Megatherium.*

At the moment of reading the last proof sheet of this memoir, the Academy of Natural Sciences has received a donation from Dr. Robert W. Gibbes, of Columbia, South Carolina, consisting of some remains of the *Megatherium mirabile*, from Skiddaway Island, Georgia, as follows: two bodies and an arch of three vertebræ; four fragments of ribs; a small fragment of a lower jaw, and the proximal extremity of a humerus.

SYNOPSIS

GENERUM ET SPECIERUM GRAVIGRADUUM QUÆ IN HOC OPERE DESCRIBUNTUR ET INDICANTUR.

FAM. GRAVIGRADA.

Pedes breves, fortissimi, æquales aut subæquales: manibus penta-vel tetradactylis, pedibus penta-? vel tetra-vel tridactylis; digitis externis 1 aut 2, muticis, ad suffultionem gressumque idoneis, reliquis falculatis.

Arcus zygomaticus clausus. Claviculæ perfectæ. Cauda mediocris, crassa, fulciens.—*Owen.*

MEGALONYX, Jefferson.

Dentes $\frac{5-5}{4-4}$ discreti; antici e reliquis remoti, magni, elliptici; reliqui superiores trigoni, inferiores tetragoni. Pedes æquales: manibus et pedibus? pentadactylis. Falculæ magnæ, compressæ. Femur capite integro. Tibia et fibula discretæ.

1. Megalonyx Jeffersonii, Harlan.—Dentes magni antici latè elliptici; superiores ultimi trigoni. Hab. America septentrionalis.—Virginia, Kentucky, Tennessee, Mississippi, Alabama.

Megalonyx, JEFFERSON, Trans. Am. Phil. Soc. IV, 1799, 246.—WISTAR, Ibid. 526, Pls. i, ii.—CUVIER, Ann. du Mus. V, 1804, 358, Pl. xxxiii, *figuræ omnes*, Fig. 13? *excepta.*—IB. Ossem. Foss. Ed. 4, VIII, 1836, 304, Pl. ccxvi, Fig. 13? *excepta.*—COOPER, Ann. Lyc. Nat. Hist. III, 1836, 166.

Megatherium Jeffersonii, DESMAREST, Mammalogie, 1820, 366.

Megalonyx Jeffersonii, HARLAN, Faun. Amer. 1825, 201.—IB. Med. and Phys. Res. 1835, 271.

Megalonyx laqueatus, HARLAN, Journ. Ac. Nat. Sc. Ph. VI, 1830, 269, Pls. xii–xiv. —IB. Med. and Phys. Res. 1835, 273; IB. 319, Pls. xii–xiv, et xv, Fig. 5–7.—WYMAN, Am. Journ. Sc. and Arts, X, 1850, 58, Fig. 1, 2.—LEIDY, Proc. Ac. Nat. Sc. Ph. VI, 1852, 117.

Aulaxadon seu *Pleurodon*, HARLAN, Journ. Ac. Nat. Sc. Ph. VI, 1830, 284.—IB. Med. and Phys. Res. 1835, 330.

Megatherium boreale, OKEN.

Onychotherium, FISCHER.

Megalonyx potens, LEIDY, Proc. Ac. Nat. Sc. Ph. VI, 1852, 117.

2. Megalonyx dissimilis, Leidy.—Dentes magni antici angustè elliptici; superiores ultimi vix trigoni sed potius elliptici. Hab. America septentrionalis.—Mississippi.

Megalonyx dissimilis, LEIDY, Proc. Ac. Nat. Sc. Ph. VI, 1852, 117.—IB. Ancient Fauna of Nebraska, 9.

GNATHOPSIS, Leidy.

Dentes $\frac{5-5}{4-4}$ discreti; inferiores antici elliptici; secundi et tertii ovati.

1. **Gnathopsis Oweni,** Leidy.—Hab. America meridionalis.
   Megalonyx Jeffersonii, OWEN, Zool. Beagle, Foss. Mam. 1840, 99.
   Gnathopsis Oweni, LEIDY, Proc. Ac. Nat. Sc. Ph. VI, 1852, 117.

EREPTODON, Leidy.

Dentes $\frac{5-5}{4-4}$ discreti?; antici? magni, elliptici, pagina externa? laqueata.

1. **Ereptodon priscus,** Leidy.—Hab. America septentrionalis. Mississippi.
   Proc. Ac. Nat. Sc. Ph. VI, 1853, 241.—IB. Anc. Fauna of Nebr. 10.

MYLODON, Owen.

Dentes $\frac{5-5}{4-4}$ discreti; superiores antici subelliptici, e reliquis modice remoti; secundi elliptici; reliqui trigoni, pagina interna sulcata; inferiores antici elliptici; penultimi tetragoni; ultimi maximi, bilobati. Pedes æquales: manibus pentadactylis et pedibus tetradactylis. Falculæ magnæ, semiconicæ, inæquales.

Caput femoris ligamento rotundo impressum. Tibia et fibula discretæ.—*Owen.*

1. **Mylodon Darwinii,** Owen.—Maxilla inferior symphyse longiore, angustiore; molares secundi subelliptici; ultimi bisulcati, sulco interno angulari.—*Owen.* Hab. America meridionalis.
   Glossotherium, OWEN, Zool. Beagle, Foss. Mam. 1840, 57.
   Mylodon Darwinii, OWEN, Ibid. 68.—IB. Mem. on the Mylodon, 1842, 154.

2. **Mylodon Harlani,** Owen.—Maxilla inferior symphyse breviore, latiore; molares secundi subquadrati; ultimi trisulcati, sulco interno bi-angulari.—*Owen.* Hab. America septentrionalis. Kentucky, Mississippi, Missouri, Carolina meridionalis, Oregon.
   Megalonyx laqueatus, HARLAN, Med. and Phys. Res. 1835, 334, Pl. xv, Fig. 2–4.
   Mylodon Harlani, OWEN, Zool. Beagle, Foss. Mam. 1840, 68.—IB. Mem. on the Mylodon, 1842, 15.
   Orycterotherium Missouriense, HARLAN, Proc. Am. Phil. Soc. II, 1841, 119.—IB. Am. Journ. Sci. and Arts, XLIV, 1843, Pl. i—iii.
   Mylodon seu *Megalonyx?* PERKINS, Am. Journ. Sci. and Arts, XLII, 1842, 136, Fig. 1–4.
   Orycterotherium Oregonense, PERKINS, Am. Journ. Sci. and Arts, XLIV, 1843, 80.
   Eubradys antiquus, LEIDY, Proc. Ac. Nat. Sc. Ph. VI, 1853, 241.—IB. Anc. Faun. of Nebr. 10.
   Megalonyx potens, LEIDY (*Errore typograph. in Anc. Faun. Nebr.* 10, *sub Eubrad. antiq. positus*).

3. **Mylodon robustus,** Owen.—Maxilla inferior symphyse breviore, latiore; molares secundi subtrigoni; ultimi trisulcati, sulco interno rotundato.—*Owen.* Hab. America meridionalis.
   Mylodon robustus, OWEN, Mem. on the Mylodon, 1842.

MEGATHERIUM, Cuvier.

Dentes $\frac{5-5}{4-4}$ discreti tetragoni, coronide transversim sulcata. Manus tetradactylæ; pedes tridactyli, digitis duobus externis muticis. Falculæ magnæ, diversiformes, digitorum mediorum maximæ, compressæ. Femur capite integro. Tibia cum fibula utraque extremitate concreta.—*Owen.*

1. **Megatherium Cuvieri,** Desm.—Megatherium Americæ meridionalis.
   Megatherium Cuvieri, DESMAREST, Mamm. 1804, 365.

2. **Megatherium mirabile,** Leidy.—Megatherium Americæ septentrionalis. Georgia, Carolina meridionalis.
   Megatherium, CUVIER, MITCHELL, An. Lyc. Nat. Hist. I, 1824, 58, Pl. vi, Fig. 12, 13.—COOPER, Ibid. 114, Pl. viii; Ibid. II, 1828, 267.
   Megatherium Cuvieri, (Desm.) HARLAN, Fauna Amer. 200.—HODGSON, Mem. on the Megath. etc. 1846.

SCELIDOTHERIUM, Owen.

Dentes $\frac{5-5}{4-4}$ discreti; superiores trigoni; antici inferiores trigoni; secundi et tertii subcompressi, pagina externa sulcata; ultimi maximi bilobati.

Caput femoris ligamento tereti impressum. Tibia et fibula discretæ. Falculæ magnæ, semiconicæ.—*Owen.*

1. **Scelidotherium leptocephalum,** Owen.—Hab. America meridionalis.
2. **S. Cuvieri,** O.—Hab. America meridionalis.
3. **S. Bucklandi,** O. " " "
4. **S. minutum,** O. " " "

EXPLANATION OF THE PLATES.

PLATE I.

MEGALONYX JEFFERSONII. View of the left side of the skull, with the lower jaw; two-thirds the diameter of nature. From the specimen of Dr. Owen's collection.

The lower portion of the outer side of the first molar alveolus of the upper jaw, destroyed in the specimen, has been represented in its restored condition. The malar bone is lost; and so, also, are the first and third molar teeth of the lower jaw.

PLATE II.

MEGALONYX JEFFERSONII. View of the upper part of the same skull as that represented in the preceding plate. Two-thirds the diameter of nature.

The malar bones and the right zygomatic process are lost.

PLATE III.

MEGALONYX JEFFERSONII. View of the base of the skull; from the same specimen as the preceding plates. Two-thirds the diameter of nature.

The malar bones, pterygoid processes, the right zygomatic process, the left second molar tooth, and the last right molar tooth are lost.

PLATE IV.

MEGALONYX JEFFERSONII. View of the left side of the skull; two-thirds the size of nature. From the specimen of Dr. Dickeson's collection.

The first molar alveolus has been represented in its perfect condition, though broken away externally in the specimen. The malar bones, zygomatic processes, and pterygoid processes are lost.

PLATE V.

MEGALONYX JEFFERSONII. Figures two-thirds the diameter of nature.

Fig. 1. Upper view of the right side of the lower jaw, from the same specimen as that represented in Plate I.

Fig. 2. Inner view of the same specimen.

The first and third molar teeth are lost.

PLATE VI.

Megalonyx Jeffersonii. Fig. 1. View of the hard palate and teeth, from the skull represented in Plate IV. Three-fifths the diameter of nature. (The anterior portion of the figure is that to the left of the plate.)

The first molar teeth of both sides, and the posterior two of the left side are not contained within their sockets, and all except one of the former are lost in the specimen.

Fig. 2. Anterior view of the skull represented in Plates I–III. One half the diameter of nature.

On both sides of the specimen the external portion of the first molar alveolus is destroyed, but on the right side of the figure it is represented in a restored condition.

Fig. 3. Posterior view of the skull represented in Plates I–III. One half the diameter of nature.

The remaining figures are of the natural size.

Fig. 4. Inner view of a first upper molar tooth of the right side. From a specimen, in Prof. Silliman's collection, found at Memphis, Tennessee.

Fig. 5. View of the triturating surface of the same specimen as the preceding figure.

Fig. 6. Inner view of a first upper molar tooth of the left side. From a specimen, in Dr. Dickeson's collection, found in a ravine near Natchez, Mississippi.

Fig. 7. View of the triturating surface of the same specimen as the preceding figure.

Figs. 6 and 7 are from the specimen which was formerly thought to characterize a species of *Megalonyx*, to which the name of *M. potens* was given.

Fig. 8. View of an isolated molar tooth, probably not belonging to *Megalonyx Jeffersonii*. From a specimen, in Prof. Wyman's collection, found in Tuscumbia Co., Alabama.

Fig. 9. View of the triturating surface of the same specimen as that represented in the preceding figure.

Fig. 10. Posterior view of the last lower molar tooth of the right side, from the specimen represented in the jaw in Plates I and V.

Fig. 11. View of the triturating surface of the same specimen as that represented in the preceding figure.

PLATE VII.

Megalonyx Jeffersonii. All the figures are from specimens in Dr. Owen's collection, and are one half the diameter of nature, except 7 and 8, which are from a specimen in Dr. Dickeson's collection, and measure two-thirds the diameter of nature.

Fig. 1. Inferior view of the atlas.

Fig. 2. Anterior view of the same specimen.

Fig. 3. Lateral view of the axis.

Fig. 4. Lateral view of one of the posterior cervical vertebræ

Fig. 5. Inferior view of the last sacral vertebra.

Fig. 6. Anterior view of an anterior caudal vertebra.

Fig. 7. The hyoid bone.

Fig. 8. Lateral view of the same specimen.

PLATE VIII.

Megalonyx Jeffersonii. Figures 1 to 5 inclusive, are one-third the diameter of nature, and the remainder are one-half. Figures 1, 2, 9, 10 *A*, 11 *A*, 12 *A*, and 13 *A*, are from specimens in Dr. Dickeson's collection; 3 and 4 are from specimens of Mr. Wetherill's collection; and the remaining ones are from specimens of Dr. Owen's collection.

Fig. 1. Fragment of the scapula. Dorsal view, representing the coraco-acromial arch entire.

Fig. 2. Inferior view of the same specimen, exhibiting the glenoid fossa and the coraco-acromial arch.

Fig. 3. Inner or subscapular view of the lower portion of the scapula of a young animal, exhibiting the development of the coracoid process as a distinct bone. *A*, *B*, suture of the coracoid process; *C*, partial epiphysis of the glenoid fossa.

Fig. 4. Inferior view of the same specimen from which the preceding figure was taken.

Figs. 3 and 4, are from one of the specimens upon which Dr. Harlan originally proposed the *Megalonyx laqueatus*.

Fig. 5. The clavicle.

Fig. 6. Palmar view of the right scapho-trapezial bone *A*, and the lunar bone *B*.

Fig. 7. Intercarpal view of the same specimens. *c*, articular surface for the first metacarpal bone; *d*, articular surface for the trapezoid bone; *e*, *f*, *g*, three articular surfaces for the os magnum; *h*, articular surface for the cuneiform bone.

Fig. 8. *A*, *B*. Radial articular surfaces of the same specimens.

Fig. 9. Palmar view of the right lunar bone *A*, and the cuneiform bone *B*. *c*, articular surface for the scapho-trapezial bone; *d*, articular surface for the radius; *e*, articular surface for the ulna; *f*, articular surface for the pisiform bone.

Fig. 10. Palmar view of the right os magnum *A*, and the unciform bone *B*. *c*, articular surface for the trapezial portion of the scapho-trapezium; *d*, articular surface for the lunar bone; *e*, articular surface for the cuneiform bone.

Fig. 11. *A*, *B*. Radio-ulno-carpal view of the same specimens as those represented in figure 9. *c*, articular surface for the ulna; *d*, articular surface for the pisiform bone.

Fig. 12. *A*, *B*. Intercarpal view of the same specimens as those represented in figure 10. *c*, *d*, *e*, the corresponding articular surfaces to those marked with the same letters in figure 10.

Fig. 13. *A*, *B*. Metacarpal view of the same specimens as those represented in figures 10 and 12. *c*, *d*, *e*, articular facets for the median metacarpal bone; *f*, articular surface for the annular metacarpal bone; *g*, articular surface for the auricular metacarpal bone.

Fig. 14. The right pisiform bone. *a*, articular surface for the unciform bone and the ulna.

PLATE IX.

Megalonyx Jeffersonii. All the figures are one-third the diameter of nature. Figures 1 to 4 inclusive are from specimens in Dr. Owen's collection, and the others are from specimens of Jefferson's collection.

Fig. 1. Anterior view of the left humerus.

Fig. 2. Posterior view of the left humerus.

Fig. 3. Head of the same specimen.

Fig. 4. Antebrachial border of the same specimen.

Fig. 5. Front view of the left radius and ulna.

Fig. 6. Carpal extremities of the same specimens.

Fig. 7. Proximal end of the left ulna.

PLATE X.

Megalonyx Jeffersonii. Figure 1 is one-third the diameter of nature, while all the other figures are one half. Figures 1, 18, and 19 are from specimens of the Jefferson collection, and the others are from specimens in Dr. Owen's collection.

Fig. 1. Dorsal view of the left radius and ulna.

Figs. 2–5. Outer view of the median metacarpal bone and phalanges.

Figs. 6–9. Upper view of the median metacarpal bone in conjunction with the annular metacarpal bone, and of the median phalanges.

Fig. 10. Inferior view of the last median phalanx.

Fig. 11. Carpal surface of the annular metacarpal bone. The three divisions of the surface from right to left of the figure, articulate with the auricular metacarpal bone, the unciform bone, and the median metacarpal bone.

Fig. 12. Outer view of the annular metacarpal bone.

Fig. 13. Carpal surface of the median metacarpal bone. The left upper lobe articulates with the index metacarpal, trapezoid, and magnum bones; the lower lobe articulates with the os magnum; and the right upper lobe articulates with the latter and with the unciform bone.

Fig. 14. Inner view of the proximal end of the median metacarpal bone, with the articular surface for the annular metacarpal bone.

Fig. 15. Inner view of the index metacarpal bone. The articular facet at the upper part of the proximal extremity is for the median metacarpal bone.

Fig. 16. Carpal surface of the index metacarpal bone.

Fig. 17. Outer view of the proximal extremity of the index metacarpal bone, with the articular surface for the first metacarpal bone.

Fig. 18. Dorsal view of the left auricular metacarpal bone.

Fig. 19. Outer view of the same specimen. The articular facet at the proximal end is for the annular metacarpal bone.

Fig. 20. Lateral view of the ungual phalanx of the thumb.

PLATE XI.

Megalonyx Jeffersonii. All the figures are one-third the diameter of nature, and are from specimens in Dr. Owen's collection.

Fig. 1. Front view of the left femur.

Fig. 2. Back view of the left femur.

Fig. 3. Distal view of the left femur.

Fig. 4. Proximal view of the left tibia.

Fig. 5. Outer view of the patella.

Fig. 6. Inner view of the patella.

PLATE XII.

Megalonyx Jeffersonii. All the figures are one-third the diameter of nature, and are from specimens in Dr. Owen's collection.

Fig. 1. Front view of the left tibia.

Fig. 2. Outer view of the left tibia.

Fig. 3. Back view of the left tibia.

Fig. 4. Distal view of the left tibia. *a*, fibular articulation; *b*, articular surface for the astragalus.

Fig. 5. Outer view of the left os calcis.

Fig. 6. Anterior view of the left os calcis. *a*, *b*, articular surfaces for the astragalus; *c*, articular surface for the cuboid bone.

Fig. 7. Upper view of the left astragalus. The large articular surface is for the tibia; the angular fossa receives a short process of the latter; and the concave fossa of the apophysis articulates with the scaphoid bone.

Fig. 8. Inferior view of the astragalus. The upper broad articular surface is for the calcaneum; and the articular surface, seen on the apophysis, joins, from right to left and downward, the calcaneum, and the cuboid and scaphoid bones.

Fig. 9. Anterior view of the astragalus, with the articular surface for the scaphoid bone.

Fig. 10. Outer view of the astragalus. *a*, articular surface for the fibula; *b*, articular surface for the cuboid bone.

PLATE XIII.

Megalonyx Jeffersonii. The figures are all one-half the diameter of nature, and are from specimens in Dr. Owen's collection.

Fig. 1. Dorsal view of the right external cuneiform bone.

Fig. 2. Its distal articular surface, for the third metatarsal bone.

Fig. 3. Its proximal view, presenting a large articular surface, on the left of the figure, for the scaphoid bone, and a small one to the right for the cuboid bone.

Fig. 4. Dorsal view of the right cuboid bone.

Fig. 5. Articular surface of the same specimen, for the last two metatarsal bones. The figure should have been turned with the concave border to the right, so as to correspond with figures 14* and 16.

Fig. 6. The cuboid bone articulating with the fourth metatarsal bone, and exhibiting an articular surface, which joins the external cuneiform and scaphoid bones, and the astragalus.

Fig. 7. The scaphoid bone, exhibiting the articular surface for the astragalus, and part of that for the cuboid bone.

Fig. 8. Distal view of the same bone, exhibiting articular surfaces for two cuneiform bones.

Fig. 9. Inner view of the second metatarsal bone.

Fig. 10. Outer view of its proximal extremity.

Fig. 11. Tarsal view of the same specimen.

Fig. 12. Dorsal view of the fourth metatarsal bone.

Fig. 13. Inner view of the fourth metatarsal bone.

Fig. 14. Outer view of the fourth metatarsal bone.

Fig. 14*. Tarsal view of the fourth metatarsal bone.

Fig. 15. Dorsal view of the fifth metatarsal bone.

Fig. 16. Tarsal view of the fifth metatarsal bone.

Figs. 14* and 16 have inadvertently been drawn upside down.

Fig. 17. Homologue of the first and second phalanges of the median toe; lateral view.

Fig. 18. Upper view of the same specimen.

Fig. 19. Lateral view of the median ungual phalanx.

Fig. 20. Upper view of the median ungual phalanx.

Fig. 21. Lateral view of the ungual phalanx, either of the second or of the fourth toe.

PLATE XIV.

Mylodon Harlani. Figs. 1, 2. Upper and outer views of a fragment of the right side of the lower jaw, containing all the teeth except the first one. Two-thirds the diameter of nature. From a specimen found at Big-bone-lick, Kentucky, and now belonging to the New York Lyceum of Natural History.

Fig. 3. Posterior view of a right humerus, one-third the diameter of nature. The specimen is contained in the cabinet of the Academy of Natural Sciences, and was found at Big-bone-lick, Ken.

Megalonyx dissimilis. The figures are of the natural size, and are from specimens, in Dr. Dickeson's collection, found near Natchez, Mississippi.

Fig. 4. Outer view of a first inferior molar tooth of the left side.

Fig. 5. Triturating surface of the same specimen.

Fig. 6. Marginal view of the same specimen.

Fig. 7. Anterior view of a last upper molar tooth.

Fig. 8. Triturating surface of the same specimen.

Ereptodon priscus. The figures of the natural size, and taken from a specimen, in Dr. Dickeson's collection, from near Natchez, Mississippi.

Fig. 9. Side view of a molar tooth.

Fig. 10. Triturating surface of the same specimen.

Fig. 11. Marginal view of the same specimen.

PLATE XV.

Megatherium. Figs. 1, 2, are two-thirds the diameter of nature; Fig. 3, one-third; and Fig. 4 is of the natural size.

Figs. 1, 2. Outer and upper views of the left side of the lower jaw, being part of a specimen from Skiddaway Island, and now belonging to the National Institute collection.

Fig. 3. Temporo-occipital fragment of a cranium, from the right side.

Fig. 4. Fragment of a molar tooth.

PLATE XVI.

All the figures of this plate are of the natural size; and to insure their accuracy they were drawn by the author.

Megalonyx Jeffersonii. Figs. 1–6. Transverse sections of first superior molar teeth.

Fig. 1. From one of the specimens contained in the skull of Dr. Owen's collection.

Fig. 2. From the specimen contained in the skull of Dr. Dickeson's collection.

Fig. 3. From an isolated specimen, in Dr. Dickeson's collection, from near Natchez, Mississippi. This section is from the tooth which was supposed to characterize the *Megalonyx potens.*

Fig. 4 From a specimen, in Professor Silliman's collection, from Memphis, Tennessee.

Fig. 5. From a specimen, in Col. Wailes' collection, from Adams Co., Mississippi.

Fig. 6. From a specimen, in Professor Wyman's collection, from Natchez Bluffs, Mississippi.

Fig. 7. Transverse section of a cast in clay of the first inferior molar alveolus of the right side, taken from the specimen of the lower jaw, of Dr. Owen's collection.

Fig. 9. Transverse sections of the posterior four superior molars of the right side; from the skull in Dr. Owen's collection. The series *a, b, c, d,* is directed from behind forwards.

Fig. 10. A similar representation to the preceding figure; from the skull in Dr. Dickeson's collection.

Fig. 11. Section of a fourth upper molar tooth, from a specimen in the collection of Col. Wailes, from Adams Co., Mississippi.

Fig. 12. Section of a third ? upper molar, from a specimen in Professor Wyman's collection, from Natchez Bluffs, Mississippi.

Fig. 13. Section of a molar of *Megalonyx Jeffersonii* ?, in Professor Wyman's collection, from Tuscumbia Co., Alabama.

Fig. 14. Section of a second upper molar, in Professor Wyman's collection, from Natchez Bluffs, Mississippi.

Figs. 16, 17. Sections of the second and last lower molar teeth, from the specimens in the lower jaw of Dr. Owen's collection.

Megalonyx dissimilis. Fig. 8. Transverse section of a first inferior molar, in Dr. Dickeson's collection, from near Natchez, Mississippi.

Fig. 15. Section of a last superior molar, which accompanied the last-mentioned specimen.

Ereptodon priscus. Fig. 18. Transverse section of the molar tooth upon which a new genus and species have been proposed. The specimen, in Dr. Dickeson's collection, is from near Natchez, Mississippi.

Mylodon Harlani. Fig. 19. Sections of the right lower molar teeth, contained in the fragment of a jaw, found at Big-bone-lick, and now in the possession of the New York Lyceum of Natural History.

Fig. 20. Section from two fragments of a last lower molar tooth, in Col. Wailes' collection, from Mammoth Ravine, Mississippi.

Fig. 21. Fragment of a first lower molar tooth, from a specimen discovered by Captain Bowman, U. S. A., in the sands of Ashley river, South Carolina. *a.* broken longitudinal surface; *b.* lateral view; *c.* transverse section. It was upon this fragment that *Eubradys antiquus* was erroneously proposed.

INDEX.

[The names of Genera and Species described or characterized are in CAPITALS; those incidentally used are in Roman: and synonymes are in *italics*.]

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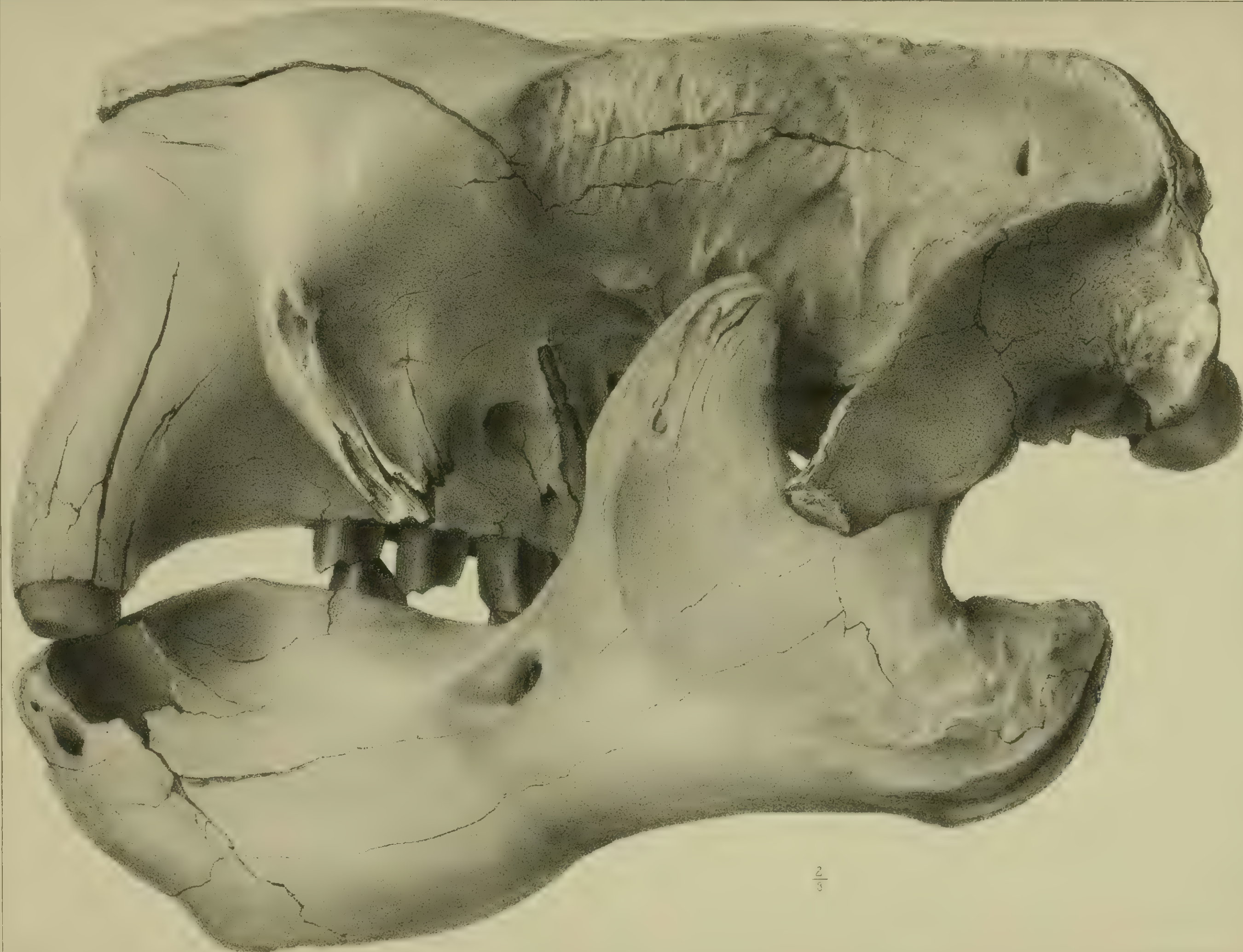
JUNE, 1855.

Plate. I



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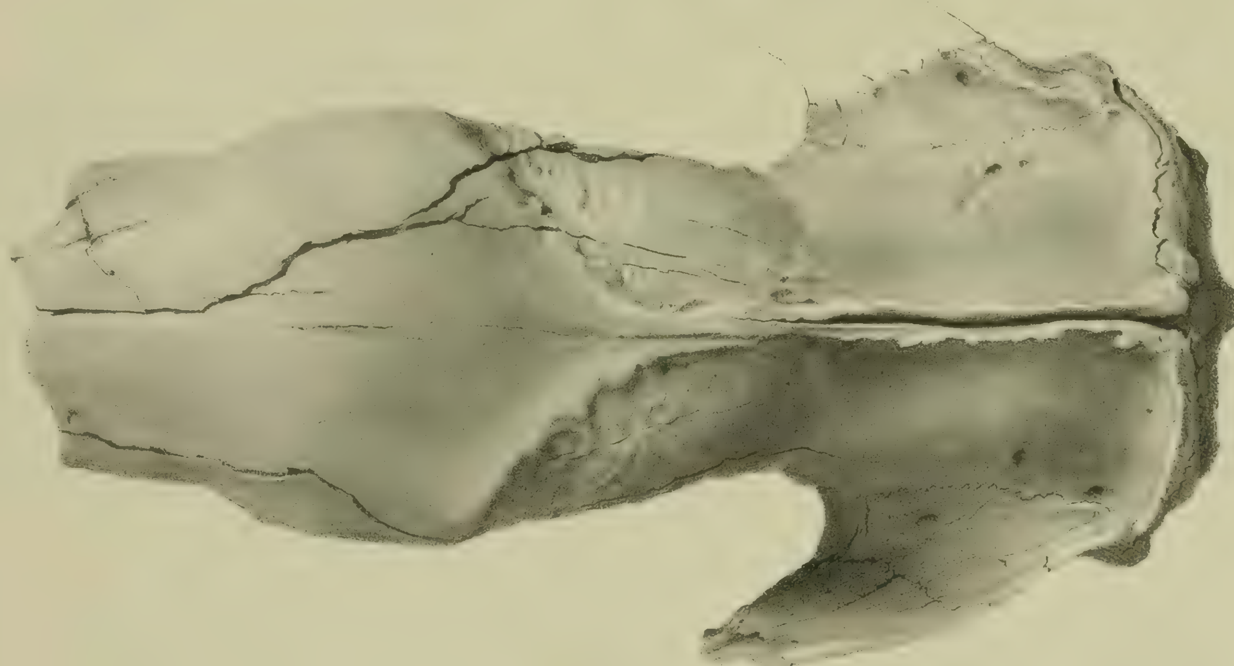
MEGALONYX JEFFERSONII, Harlan.



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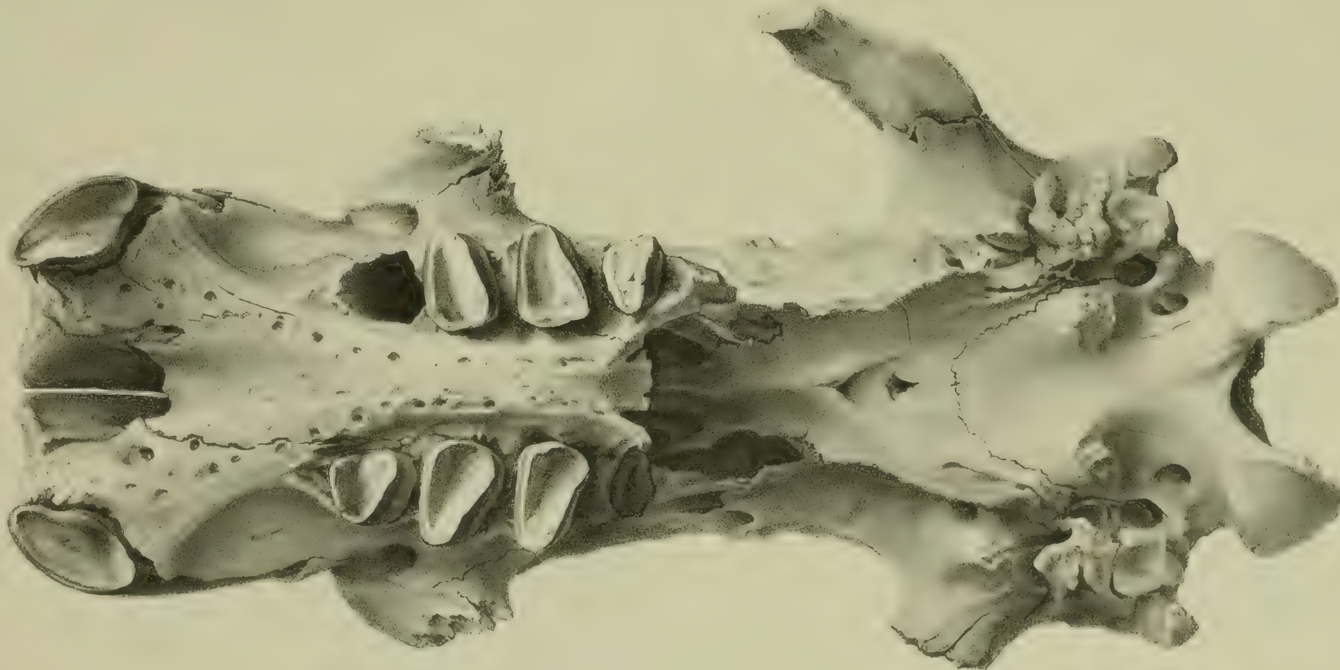
MEGALONYX JEFFERSONII, Harlan.

T. Sinclair's lith Phila.

Plate III



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MEGALONYX JEFFERSONII, Harlan.

Sinclairs lith Phila

A Frey Del

MEGALONYX JEFFERSONII, Harlan.

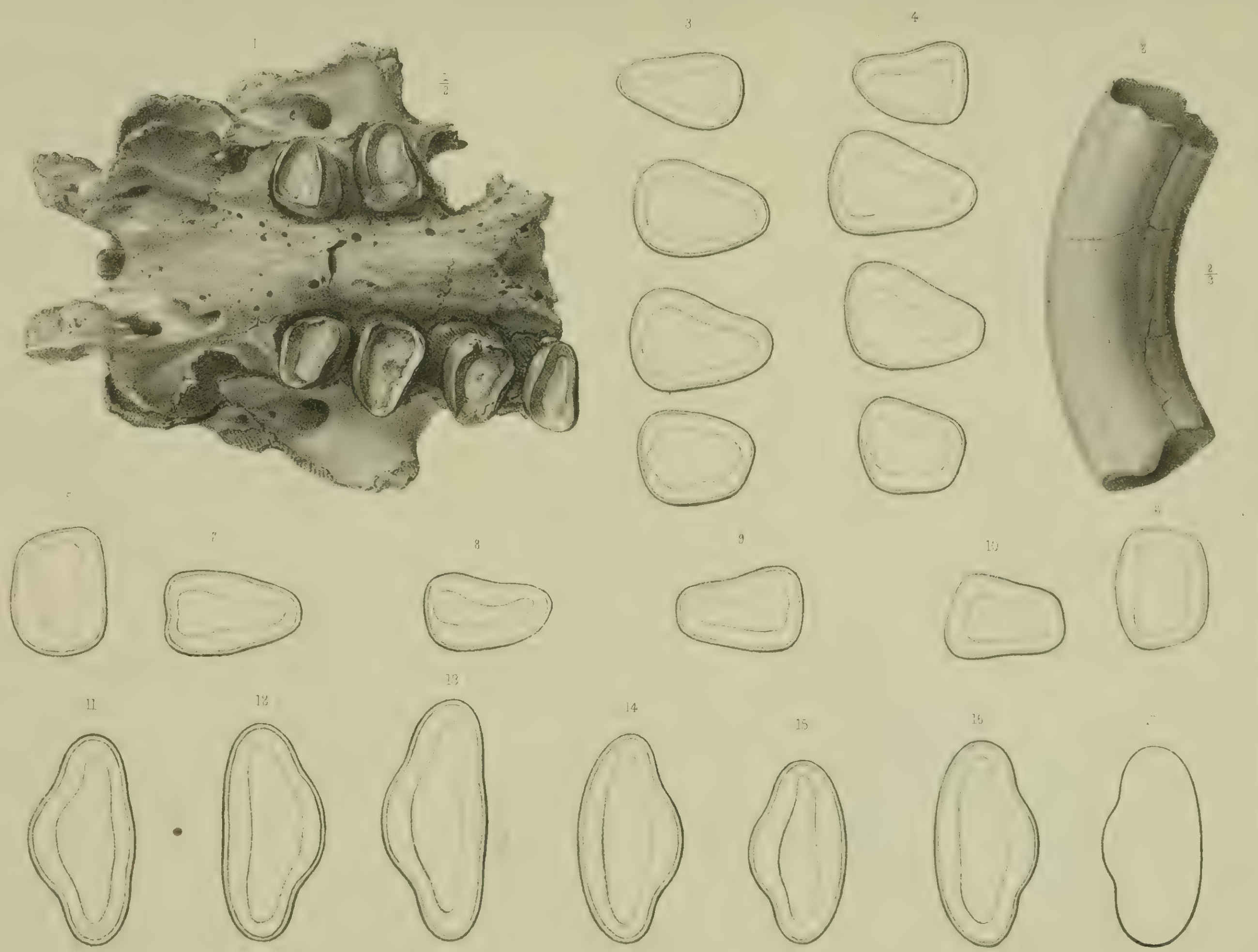
T Sinclair's lith Phila

Plate V

A Frey, Del.

MEGALONYX JEFFERSONII, Harlan

T. Sinclair's lith, Phila



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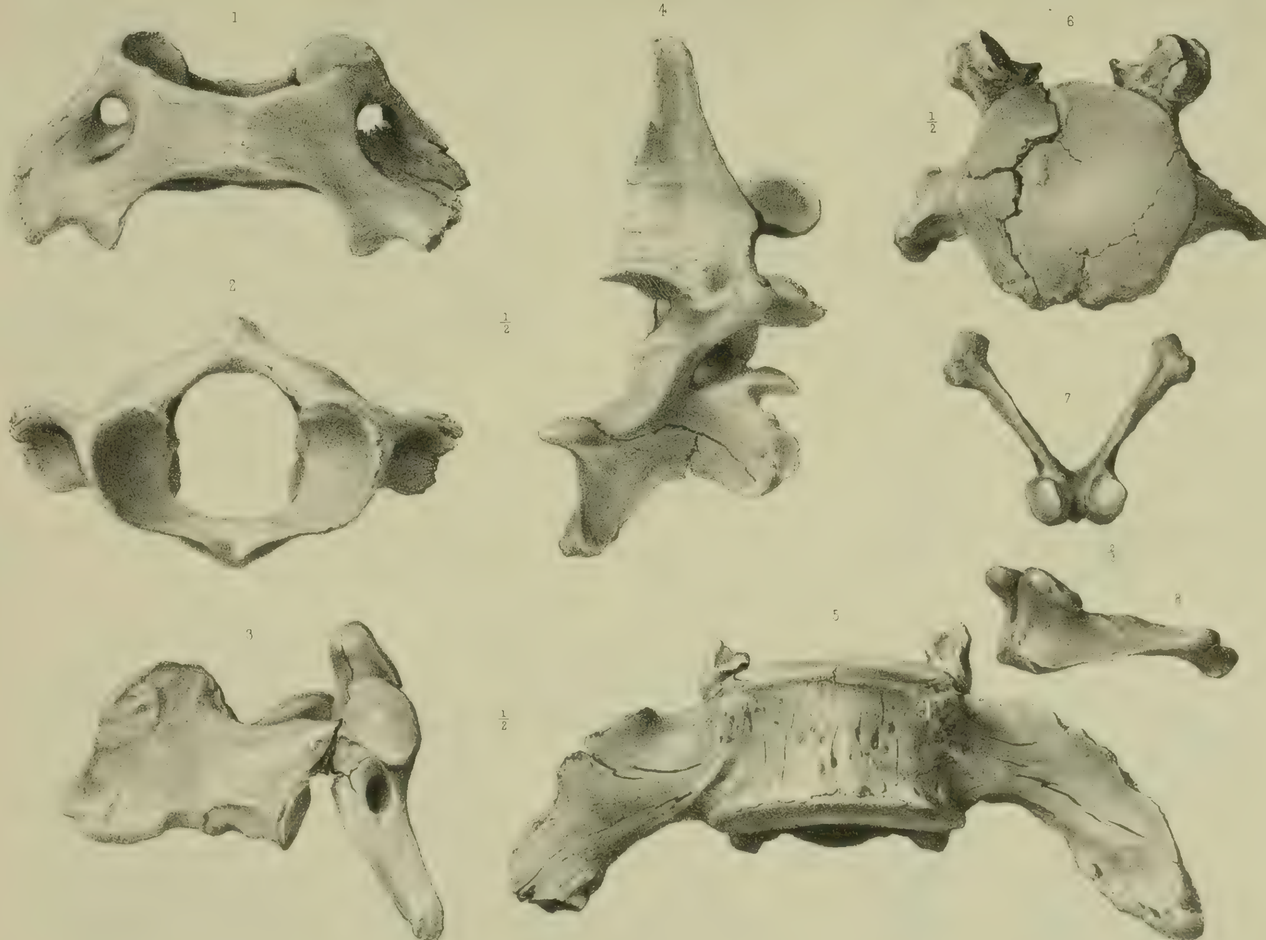

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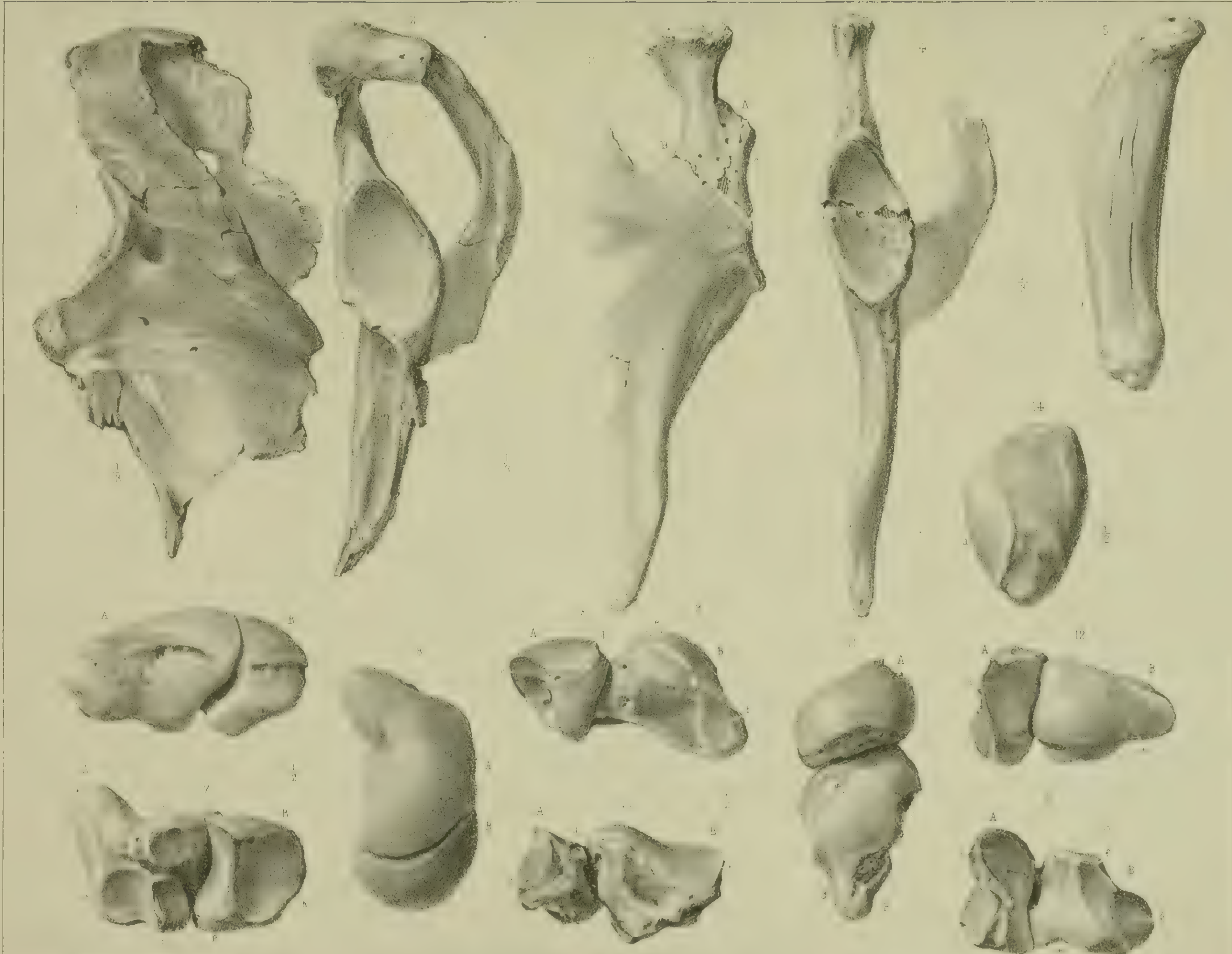
MEGALONYX JEFFERSONII, Harlan.

T. Sinclair's lith Phil

Plate VIII



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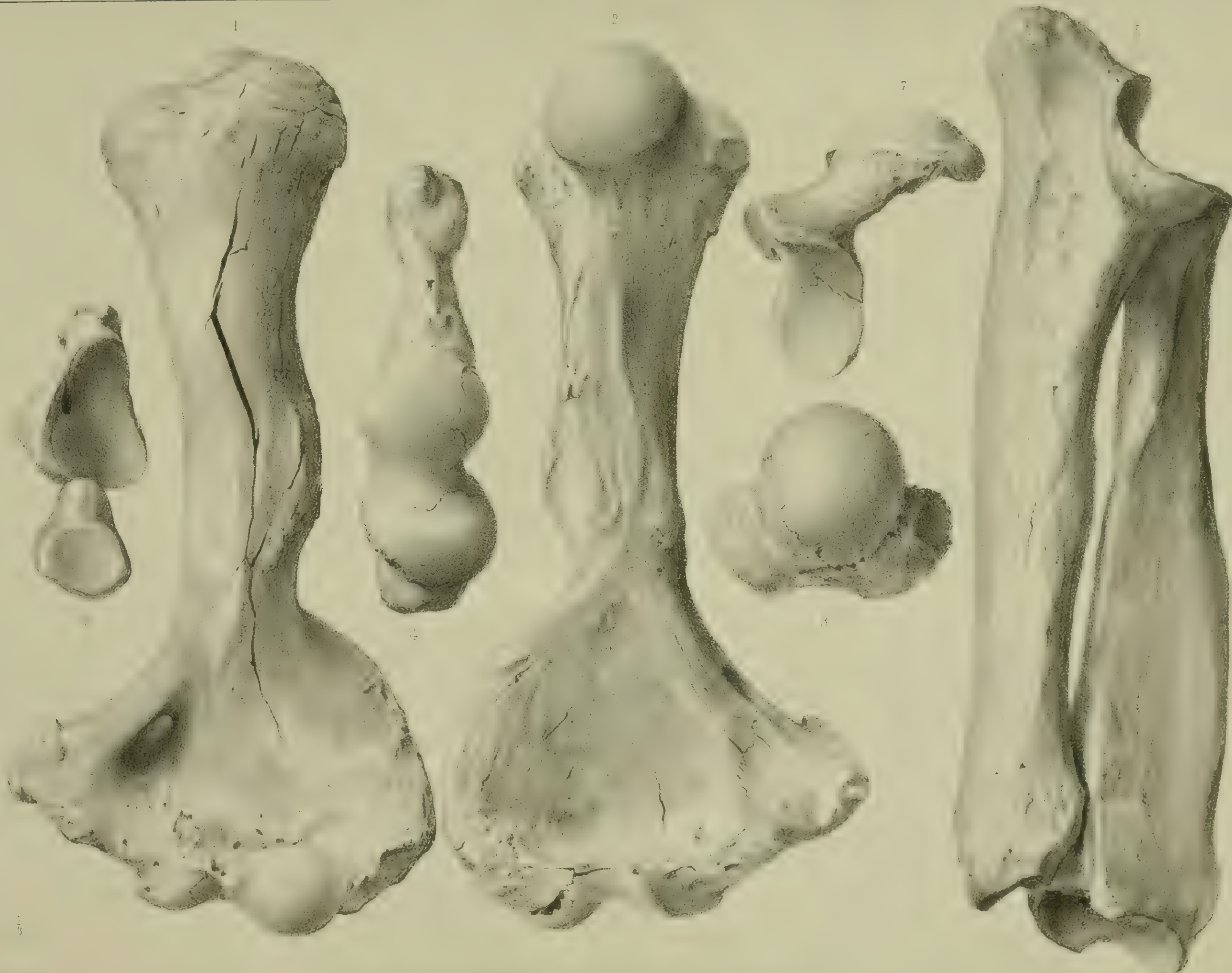
T. Sinclair's, lith, Phil.

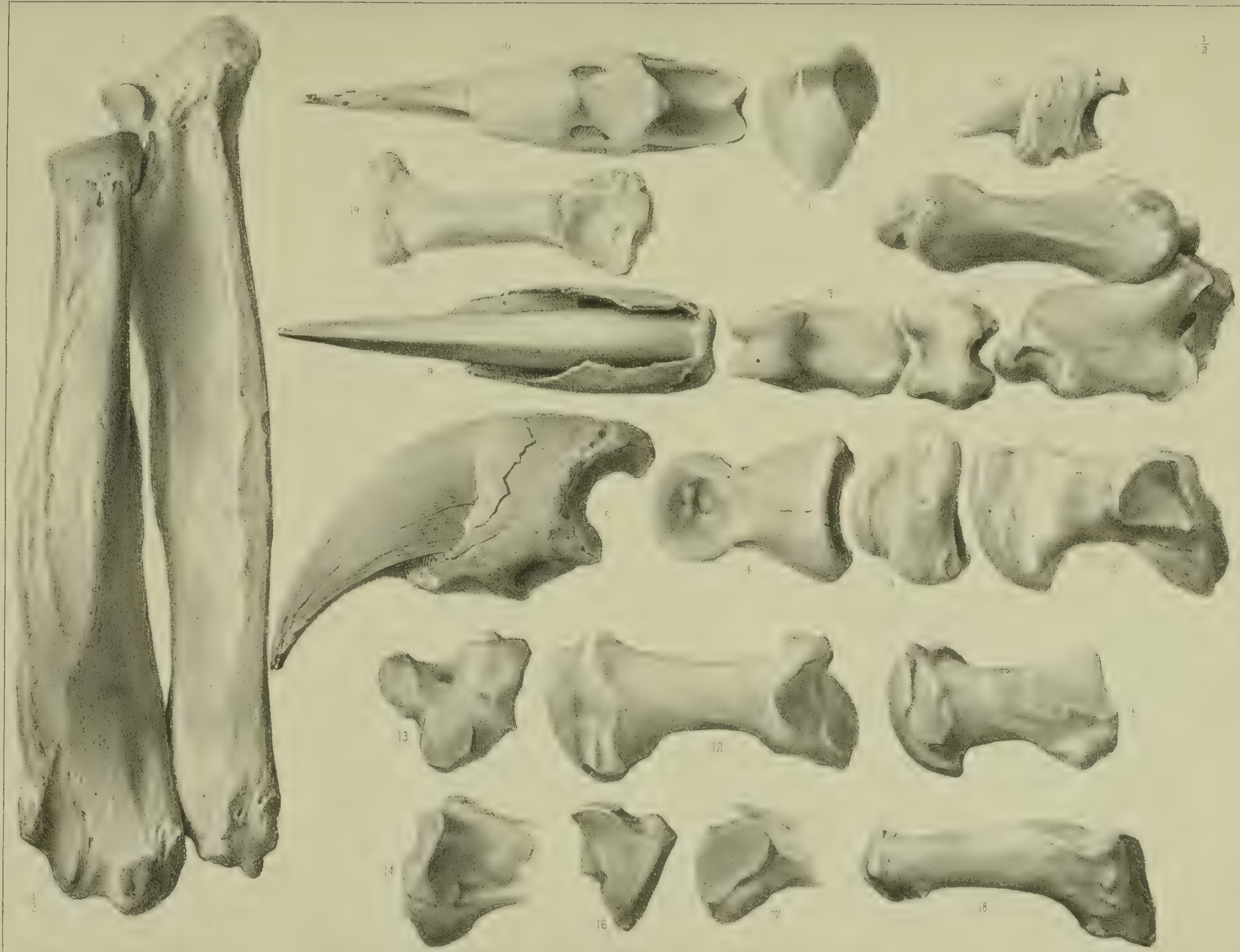


MEGALONYX JEFFERSONII. Harlan.

A. Frey. Del

T Sinclair's lith Phil

Plate X.



MEGALONYX JEFFERSONII, Harlan.

MEGALONYX JEFFERSONII, Harlan.

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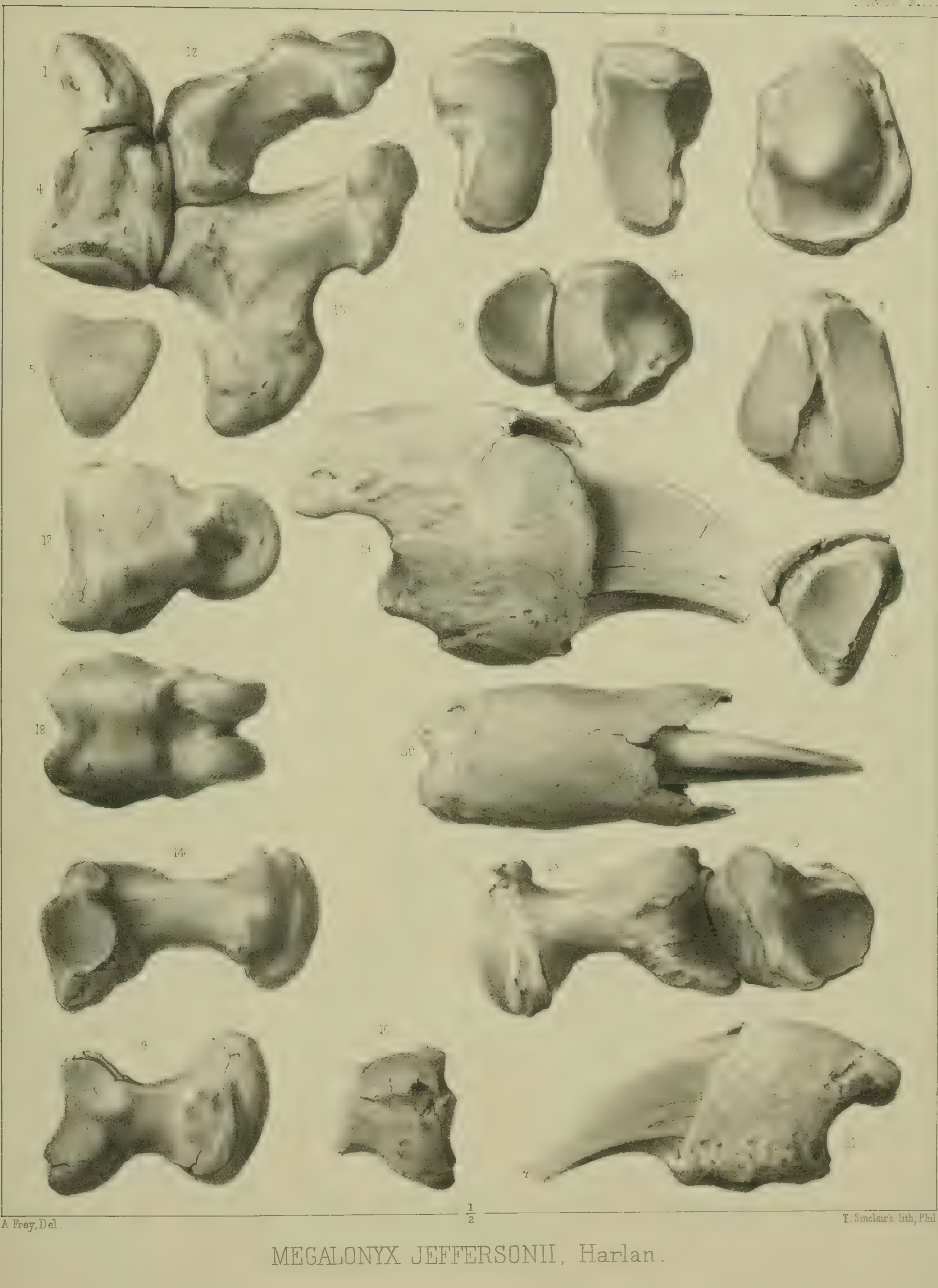
MEGALONYX JEFFERSONII, Harlan.



A. Frey, Del. $\frac{1}{2}$ T. Sinclair's lith, Phil

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A Frey, Del. 1-3 MYLODON HARLANI, Owen. 4-8 MEGALONYX DISSIMILIS, Leidy. T. Sinclair's lith.

9-10 EREPTODON PRISCUS Leidy

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A Frey Del

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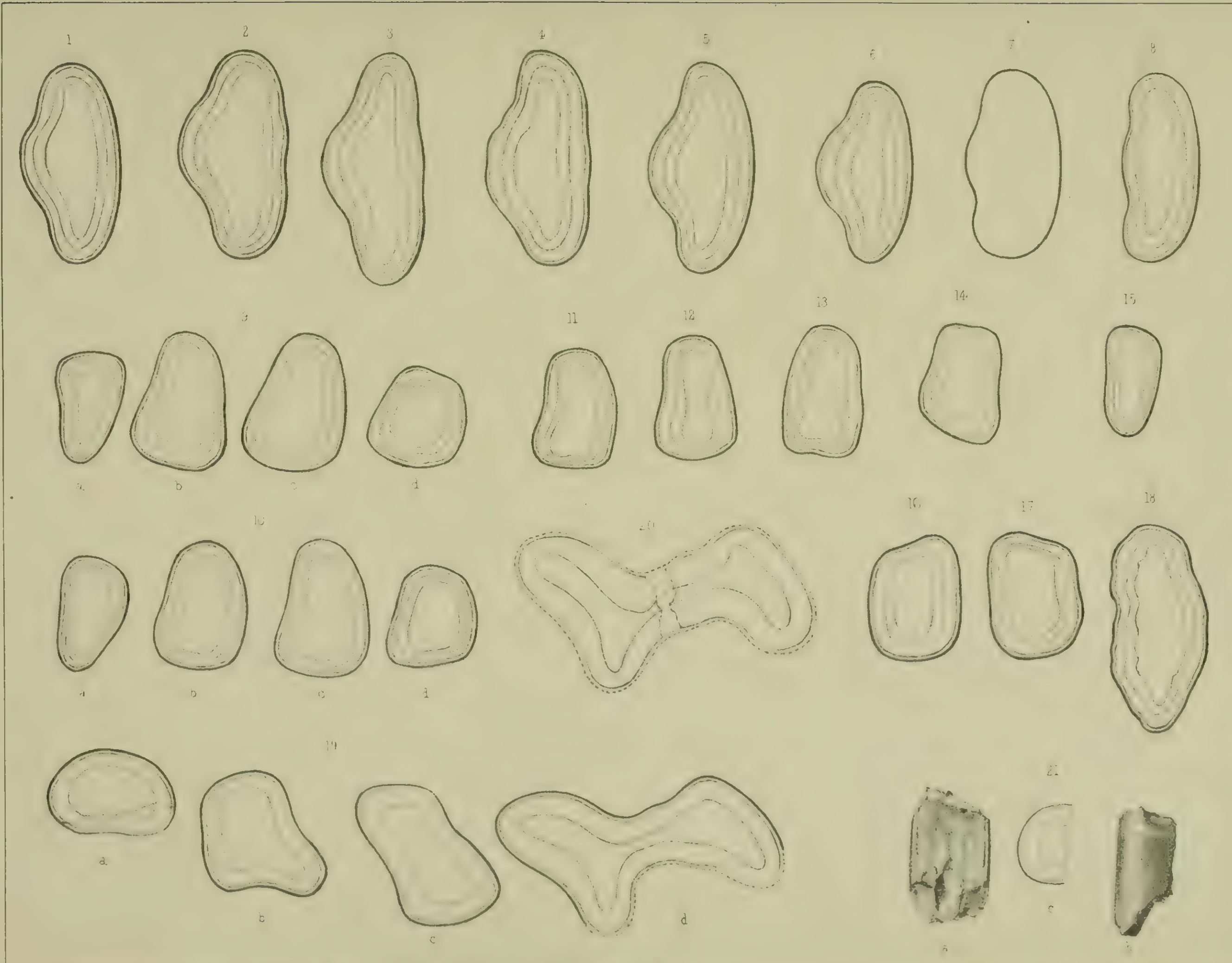
Plate XVI.



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T. Sinclair's lith. Phil.

APPENDIX.

PUBLICATIONS OF LEARNED SOCIETIES

AND PERIODICALS

IN THE LIBRARY OF THE SMITHSONIAN INSTITUTION.

PART I.

NOTICE.

The present list, prepared under the direction and at the expense of the Institution by Mr. Charles Girard, is the first of a series intended to show what works have been received in the way of exchange by the Smithsonian Institution, and includes likewise all transactions of learned societies and periodicals which have in any way been added to its library. It embraces the statistics of what has been received up to 1855 from the countries for which Dr. J. G. Flügel, of Leipsic, has acted as agent, namely: Sweden, Norway, Denmark, Russia, Holland, Germany, Switzerland and Belgium. The remaining portions will be issued as speedily as possible.

The Smithsonian Institution, desirous of collecting together all published transactions of societies and scientific periodicals, will be happy to receive from its correspondents any additions to these lists, especially where such will serve to complete series already in its possession.

Joseph Henry,
Secretary S. I.

Smithsonian Institution, January 1, 1855.

PUBLICATIONS

OF

LEARNED SOCIETIES AND PERIODICALS IN THE LIBRARY OF THE SMITHSONIAN INSTITUTION, DECEMBER 31, 1854.

PART I.

SWEDEN.

LUND.

Kongliga Universitetet.*

Physiographiska Sällskapets Tidskrift. I. Lund, 1837—1838. 8vo.

Swenska Kyrkans Historia, af Dr. H. REUTERDAHL. I & II, I, II. Lund, 1838—1850. 8vo.

Skanes Konsthistoria för Medeltiden, af C. G. BRUNIUS. Lund, 1850. 8vo.

Konstanteckningar under en Resa är 1849, fran Lund om Linköping och Strengnäs till fahlun och äter om Upsala Stockholm och Vexiö, af C. G. BRUNIUS. Lund, 1851. 8vo.

Skandinavisk Fauna, af S. NILSSON. I, 1847 (2d ed.); III (Amfibierna), 1842; IV, I, II (Fiskarna), 1852 & 1853. Lund. 8vo.

Nordborn under Hednatiden. Populär framställning af vara Förfäders äldsta Kultur, af AXEL EM. HOLMBERG. Förra Afdelningen. Stockholm, 1852. 8vo.

Swensk Bibliography för ar 1849, eller Allmän Förteckning öfwer utkomna Böcker, Musikalier Kartor, Kapparstick och Stentryck. Utgiwen af *Boktryckeri-Societeten.* Stockholm, 1849. 8vo.

för Ar 1850.	Stockholm, 1850.
" 1851.	" 1851.
" 1852.	" 1852.
" 1853, I—XIII.	" 1853.
" 1844, I—X.	" 1854.

Tegners-Statyen. Lund, 1853. 8vo. pamph.

STOCKHOLM.

Kongliga Svenska Vetenskaps Akademien.

Kongl. Svenska Vetenskaps Academiens Handlingar. I—XL, 1739—1779. Stockholm. 8vo.

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* Unless otherwise stated, the works mentioned in this list are a donation from the society or party under the heading of which they are recorded.

STOCKHOLM.

Konglika Svenska Vetenskaps Akademien.—*Continued.*

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(*See Breslau, Schlesische Gesellschaft für Vaterländische Cultur.*)

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Naturwissenschaftlicher Verein in Halle.

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